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Executive Functions of Preschool Children with Autism Spectrum Disorders

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EXECUTIVE FUNCTIONS OF PRESCHOOL CHILDREN WITH AUTISM SPECTRUM DISORDERS

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Every day, school professionals encounter the need for research-based assessment and intervention practices which target executive function profiles in preschool children with developmental delays. While current research focuses on describing characteristics of autistic tendencies during early childhood years, very few studies exist that compare preschool children's executive function profiles based on rating scales with performance-based assessment.

The purpose of this study was to compare specific neurocognitive profiles of preschool-aged children with autism based on their performance on the NEPSY-II and on the teachers' ratings on the BRIEF-P. Additionally, this study used a quantitative design to explore whether age of symptoms onset, age of enrollment in Early Intervention services, and intensity of therapy services provided can differentiate learning profiles, particularly executive functions of preschool children with autism spectrum disorders. The sample of the study was composed of 12 preschool students ranging from 3 to 5 years of age. The sample's educational placement was an out-of-district placement. The sample was one of convenience.

A number of conclusions were obtained pertaining to age of symptoms onset and support services provided by EI before the child's third birthday. An early age of symptoms onset was considered to predict eligibility for occupational therapy services. Also, EI services were found to be associated with lower performance on the Attention and Executive Functioning domain. Results from the interaction between Attention and Executive Functioning domain, Inhibit Self Control Index, and General Executive Composite, and the comparison between Social Perception domain and Flexibility Index, did not reveal significant differences when compared with profiles from the NEPSY: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007), and the Behavior Rating Inventory of Executive Functioning-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003). The results drawn from the comparison between Memory and Learning, Emergent Metacognitive, and General Executive Composite ratings showed significantly different profiles. Lastly, this study offered recommendations for future research on executive functioning in preschool children with autism spectrum disorders (ASDs).

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> "*Don't walk in front of me, I may not follow;*
> *Don't walk behind me, I may not lead.*
> *Just walk beside me, and be my friend*"
> - Anonymous.

I also owe a debt of thanks to Dr. Solberg, principal of the Academy Learning Center, Ms. Nappi, principal of the Center for Lifelong Learning, and Dr. Finklestein, Superintendent of Middlesex Regional Educational Services, who allowed me complete the data gathering process of this project. I also would like to extend my most sincere gratitude to the teachers, paraprofessionals, and administrative assistants who took part on this project. I also would like to extend my sincere gratitude to the teachers, paraprofessionals, and administrative assistants who took part in this project. Their commitment and compassion to their students is the key for their very successful programs.

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> "*Most of the important things in life have been accomplished by people who kept trying whenever there seemed to be no hope at all.*"
> - Dale Carnegie.

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CHAPTER I

INTRODUCTION

Over the past decade, a growing number of preschool-aged children have been diagnosed with autism disorder and identified as eligible to receive special education and related services in public schools. The Individuals with Disabilities Education Improvement Act-2004 (IDEIA-2004) mandates all states to report specific childhood disabilities, including autism disorder. The IDEIA-2004 report revealed a steady increase in the number of children ages 3-22 being recorded in the autism eligibility category by their local educational agencies. Reports submitted by states in compliance with IDEIA-2004 also revealed a steady increase in the number of children ages 3-22 being recorded in the autism eligibility category by their local educational agencies. From the 1992-1993 school year to the 2005-2006 school year, the number of children eligible to receive special education services under the eligibility criteria of autism increased from 15,580 to 259,705 (www.cdc.gov/nchs and www.ideadata.org).

According to the Autism Society of America (2003), the number of reported cases of autism in the U.S. had an annual growth rate of 10-17%, making it the fastest growing developmental disability in the country. The Centers for Disease Control and Prevention (CDC, 2004) had predicted that approximately 1 in 150 children born in the U.S. will be diagnosed with characteristics compatible with some form of autism by the age of three. A collaborative CDC (2004) study designed to monitor the prevalence and incidence of autism disorders in the U.S. revealed that the state of New Jersey had the highest prevalence of children with autism disorder of the 14 states included in the study. New Jersey reported a rate of 1 in 95 children. While the prevalence rate of autism in children ages 3-22 years continued to increase, in New Jersey the majority of the cases were attributed to the age group 3-10 years, which was estimated to represent an increase of 49.8% in the prevalence rate when compared to other age groups. The prevalence increase for young children with autism represented an extreme concern due to the wide range of characteristics presented in preschool children with autism.

Many preschool children diagnosed with autism disorder exhibit a heterogeneous and inconsistent profile of strengths and weaknesses, which have been associated with a neurological etiology. Therefore, the increased prevalence of autism in preschool-aged children and the lack of developmentally appropriate assessment instruments, have led to poorly tailored interventions. This has been shown to hamper the consistent acquisition of skills and further generalization of previously acquired skills in individuals with autism (Griffith, et al., 1999; Pennington, et al., 1997; Pennington & Ozonoff, 1996).

Despite the need to provide specialized interventions during early childhood years, school professionals responsible for determining eligibility for Early Intervention (EI), such as school psychologists, are faced with assessment challenges, which impacts the quality of services offered to this population of young children with autism. Research has found that an integrative and comprehensive model of determining an individual's unique pattern of learning based on a neuropsychological model of assessment may shed light on tailored and effective early intervention (EI) practices for young children with the disorder (Filipek, Accardo, Baranek, Cook, Dawson, Gordon, et al. 1999; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Hoyson, Jamieson, & Strain, 1984; Joseph, 1999; Lord, 1997; Pennington & Welsh, 1995; Pennington & Ozonoff, 1996; Stone, 1997). Consequently, it is pivotal for school professionals to increase awareness about and accurately identify the unique patterns of strengths and weaknesses of young children with autism. In this way, they can facilitate the children's path to achieve functional lives to the best of their abilities (Filipek, et al., 1999; Sparrow, Marans, Klin, Carter, Volkmar, & Cohen, 1997; Volkmar, Klin, Szatmari, Lord, Campbell, Freeman, et al., 1994).

Autism as a Neuropsychological Disorder

According to the CDC Autism and Developmental Disabilities Monitoring Network (CDC-2007) and the National Institute of Mental Health (NIMH-2007), autism is one of a group of disorders known as Autism Spectrum Disorders (ASDs). This group of neuropsychological disorders includes core-defining characteristics related to impairments in language development, social development, and ritualistic/repetitive behaviors (American Psychiatry Association, 1994).

Language difficulties associated with autism affect the child's ability to understand and interact with the world. The language difficulties are directly associated with delays in social pragmatic development, which affect skills such as representational play, eye contact, and attention during interactive socially-mediated activities (Adrien, Lenoir, Martineau, Perrot, Hameury, Larmande, et al., 1993; Osterling & Dawson, 1994).

Social deficits and ritualistic behaviors manifest themselves in the form of a need for sameness, preference for symmetry, and systems of arranging preferred objects (Welsh & Pennington, 1988). Social impairments have been identified as an early indicator of autism-like tendencies in young children. These impairments adversely impact the child's ability to form relationships that facilitate play, imitation, and imagination skills, which are essential in developing relationships and learning social roles (Gillberg, 1989).

The last component of the triad of symptoms that defines ASDs are behaviors related to seemingly ritualistic adherence to activities and behaviors with apparently limited pragmatic purpose (Griffith, Pennington, Wehner, & Rogers, 1999; Joseph, 1999; Lord, 1997; Stone, Lee, Ashford, Brissie, et al., 1999). Traditionally, these behaviors have been studied and discussed in a medical framework based on neurological etiology (Damasio & Maurer, 1978; Diamond & Doar, 1989; Minshew, Sweeney, & Bauman, 1997). However, more recent autism research illustrates a strong relationship between certain repetitive stereotyped behaviors and executive functions, which refers to the ability to override or inhibit basic behavioral responses such as behaviors which might become self-fulfilling (i.e., spinning objects around or watching the object spinning around, enjoying the dizziness effect after spinning, avoiding a non-preferred activity) (Pennington & Welsh, 1995; Joseph, 1999; Sparrow, et al., 1997; Volkmar, et al., 1994).

Responses to Increasing Autism Rates

Recently, the Centers for Disease Control and Prevention (CDC-2007) and the National Institute of Mental Health (NIMH-2007) demonstrated that while the incidence of autism continues to increase drastically, it remains difficult to determine the accuracy of incidence rates due to contributing factors, such as the stage at which the individual developed autism and the degree of involvement of other skills. Previous studies sponsored by the CDC showed an increase in autism rates compared to the 1980s and 1990s. IDEA-Data Analysis System (IDEA-DANS) documented that in the U.S., over 25,000 preschool-aged children with a diagnosis of autism were entitled to receive special education services in the 2004-2005 school year, compared to over 20,000 in the 2003-2004 school year, and close to 15,000 in the 2000-2001 school year. The reported increase in autism rate became visible from the first multi-states collaborative study designed to monitor the prevalence and incidence of autism in the United States. As a result, effective research neuropsychological learning profiles of preschool children with ASDs are needed to improve traditional assessment practices and to enhance the coordination of specialized interventions, thereby maximizing their potential across all developmental components.

Chris Smith, co-chairman of the Congressional Coalition on Autism Research and Education (CARE; www.house.gov.chrissmith), has argued that the data obtained from the aforementioned study becomes a roadmap to further advance research, treatment, and the education programs created to assist, understand, and treat individuals with ASDs. Due to the complexity of the neuropsychological characteristics presented in ASDs, the individual's development is impacted throughout his/her lifespan. For example, a group of young children with autism disorder might demonstrate polarized patterns of neuropsychological strengths and weaknesses based upon different factors such as age of symptoms onset, EI, genetic factors, and overall neurocognitive skills (Adrien, et al., 1993; Filipek, et al., 1999).

According to the Autism Society of America, (ASA, 2003) an increasing number of students with disabilities, including autism, are entering regular education settings. Currently, there are no specific blood tests, x-rays, or medical diagnostic procedures to confirm or diagnose autism. Although the current guidelines used to identify children with autism (APA, 1994) represent a consensus regarding a diagnosis, the guidelines merely constitute a categorical description of a complex brain-based disorder. Lord (1997) and Minshew, et al. (1997) suggested that marked emphasis on categorical definitions of autism overlooks critical developmental considerations and possibly leads to inaccurate diagnosis of the disorder, consequently impacting overall developmental outcomes. A neuropsychological model derived from specific brain-based profiles of strengths and weaknesses perhaps could provide an accurate understanding of autism as a life-long and complex disorder and ultimately provide specialists with more effective interventions at earlier stages. (Pennington & Ozonoff, 1996).

Using a neuropsychological model to differentiate a set of complex skills and to provide treatment for children with ASDs involves a two-fold challenge for specialists, particularly for those practicing in educational settings (Ozonoff, 1997; Pennington & Ozonoff, 1996). First, ASDs do not present homogeneous cognitive or behavioral characteristics. The CDC-2004 classified ASDs as a group of developmental disabilities, which includes autism disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS), atypical autism, Asperger syndrome, Rett's syndrome, and Childhood Disintegrative Disorder, making the broad diagnosis category of Pervasive Developmental Disorders (PDDs; APA, 1994). As a result, different types of autism disorders may have distinct patterns of cognitive and behavioral functions and possibly warrant tailored and specialized methods of diagnosis and intervention. Despite the evidence for existent behaviorally-based symptoms associated with autism, a challenge for school professionals is that the DSM-IV (1994) criteria provide little information essential to understanding the child's behavior and its impact on his or her learning process.

Many of the neuropsychological instruments used over the past three decades have failed to address neuropsychological functions in preschool-aged children (Flanagan & Nuallain, 2001; Harris, et al., 1991; Lord, 1995; Stone, 1997). In the past, neuropsychological tests focused on the assessment of adults with brain disorders, and only a few of them included children as part of their standardization sample (Ozonoff, Pennington, & Rogers, 1991). Sparrow, et al. (1997) argued that when using traditional standardized tests, a profile of neuropsychological functions in children with ASDs cannot be fully assessed and interpreted, since assessing loss of skills in adults with brain disorders is not comparable to assessing developmentally-acquired skills or lack of acquired skills in children with developmental disorders. Furthermore, given the heterogeneity of ASDs symptoms, it is difficult to correlate individual performance results to a larger group, in part because individual discrepancies may be influenced by the psychometric properties of the instruments used rather than by individual profiles of strengths and weaknesses.

Executive Functions and ASDs

Executive functions (EF) theory has become a major perspective for explaining symptoms associated with autism disorder (Pennington & Ozonoff, 1996; Pennington, Rogers, Bennetto, Griffith, Reed, & Shyu, 1997; Rogers, 1998). Executive functions are brain-based skills, which begin to develop during the first years of life and are associated with the pre-frontal cortex. Specifically, EF refers to the processes that underlie flexible goal-directed behavior, such as inhibiting dominant responses, creating and maintaining goal-related behavior, and using temporal-sequencing behavior (Burgess, Alderman, Evans, Emslie, & Wilson, 1998). Therefore, difficulties associated with EF may provide explanations for the consistently discrepant performance of young children with ASDs. Damasio and Maurer (1978) and Griffith, Pennington, Wehner, and Rogers (1999) demonstrated that children with autism exhibited cognitive difficulties, which impacted their ability to plan and to problem-solve. Even though the relationship between EF and preschool children with autism has not been extensively studied, researchers have supported the notion that pervasive disorders appear to be related to deficits in executive functions in individuals with autism (Ozonoff, Rogers, & Pennington, 1991; Pennington & Ozonoff, 1996).

Researchers seeking to understand the relationship between executive functions and autism disorder have identified brain structures that are directly related to social, behavioral, and communication impairments. Specifically, executive function impairments have been associated with damage to the prefrontal cortex (Fuster, 2000; Luria, 1966). The relationship between deficits in EF and individuals diagnosed with autism has gained support in regard to an overlapping group of symptoms associated with the third category in the autism triad, restricted and repetitive interests and behaviors (Griffith, et al., 1999; Stone, Lee, Ashford, Brissie, et al., 1999). Other categories of the autism triad, such as language and social aspects, appear to be less related to EF; however, researchers have suggested that EF may be tied to other cognitive domains that govern language and social development (Ozonoff, Pennington, & Rogers, 1991). Stone (1997) documented that impairments of EF may be related to both language and social functions, as in the case of an individual's inability to inhibit repetitive verbal responses in a given situation, which may cause autism-like behaviors that negatively impact social interactions and language. Pennington and Ozonoff (1996) showed that executive dysfunction was pervasive in autism, and those individuals with autism exhibited a different range of symptoms when compared to other individuals with neurodevelopmental disorders.

EF also affects interaction among mental operations, which enables an individual to disengage from the immediate context in order to guide behavior by reference to mental models or future goals (Hughes, 1996; Volkmar, Chawarska, & Klin, 2005). Interaction among these mental operations is critical for the development of working memory, response inhibition, and planning in young children (Ozonoff, 1997; Pennington & Welsh, 1995). An area of growing interest in pediatric neuropsychology is the relationship between deficits of EF, problem solving and planning ability, and inhibitory control in young children with ASDs (Joseph, 1999; Ozonoff, Cook, Coon, Dawson, Joseph, Klin et al., 2004; Pennington & Ozonoff, 1996; Russell, 1997). Several decades ago, most of the cognitive research focused on neuropsychological functioning of adults with brain disorders (Damasio & Maurer, 1978; Luria, 1966). During the last two decades, more researchers have begun to closely examine the relationship of neuropsychological aspects of learning in young children, particularly those who have been impacted by life-long disorders such as ASDs. While there has been an increase of empirical research on school-aged children and subsequent methods to improve psychometric properties of neuropsychological instruments, research that provides empirical support to the EF construct in preschool children with autism remains scarce (Filipek, et al., 1999; Harris, et al., 1991; Harris & Handleman, 2000; Lord, 1997).

Neuropsychological Instruments of Executive Functioning

Researchers (Filipek et al. 1999; Flanagan & Nuallain, 2001; Griffith, Pennington, Wehner, & Rogers, 1999; Joseph, 1999; Rogers, 1998; Zelazo, Carter, Reznick, & Frye, 1997) strongly supported that individuals with autism cannot be consistently identified by their neuropsychological profiles of EF. Despite an increase in professional literature interested in exploring the relationship between deficits in EF and individuals with autism, the literature continues to be limited in exploring deficits in executive functioning in preschool children with autism. According to the research of Isquith, Crawford, Espy, and Gioia (2005), well-researched, standardized diagnostic instruments can differentiate ASD characteristics in young children at an early age. Moreover, earlier and accurate differentiation of such complex brain-related behaviors, combined with effective interventions, can be implemented to help the young child with autism achieve his or her greatest functional potential.

Current practices in the use of neuropsychological instruments advocate a comprehensive, developmental model to categorize neuropsychological functions in the pediatric population with disabilities. The NEPSY: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007), which became standardized as a pediatric neuropsychological instrument, has demonstrated the ability to discriminate patterns of basic neuropsychological functions, specifically frontal and prefrontal lobe functioning across disabilities. The NEPSY-II provides a flexible and comprehensive model, based on Luria's theory, to categorize patterns of abilities or deficiencies in complex behaviors, such as tactile perception, visual perception, basic psychomotor skills, and other functions (Korkman, Kemp, & Kirk, 2001).

The theory developed by Luria (1966) constitutes the theoretical basis for the development of the NEPSY-II. Luria believed that the integration and independence of different parts of the brain were necessary for complex cognitive processes to occur. This integration of functional systems was a central component of Luria's theory (1966). In his theory, Luria considered cognitive processes to be dynamic, functional systems characterized by a specific aim and carried out as complex patterns of participating sub-processes (Korkman, Kemp, & Kirk, 2001). With the NEPSY-II, Luria's theory was represented as the assessment of complex sub-components of cognitive functions that can be impaired in ways that are comparable to that which occurs in the breakdown of a complicated system (Korkman, Kirk, & Kemp, 2007). Indeed, the NEPSY-II was designed to assess both qualitative and quantitative aspects of sub-components of complex cognitive functions that require contributions from several functional domains. Conceptually, the integration of Luria's theoretical view and the NEPSY-II analysis identified complex, disordered functions by separating all sub-processes that would normally participate in that particular function.

Another reliable method of neurodevelopmental screening, especially for evaluation of executive functions in school-aged children, includes behavior rating scales completed by external raters (e.g., parents or teachers). Gioia, Isquith, and Guy (2001) emphasized the relevance of combining both observational rating scales and results from other assessment measures in order to support clinical data derived from standardized measures of executive functions. The integration of empirically-based and developmentally-based data regarding executive functioning becomes pivotal to closely examining the impact on a child's academic and social development, especially considering the heterogeneous characteristics presented in developmental disorders such as ASDs. The Behavior Rating Inventory of Executive Functioning-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003) is a standardized rating scale developed with the purpose of increasing the understanding of everyday situations related to specific domains of executive functioning in children from 2 to 5 years of age. The BRIEF-P is a 63-item performance-based rating scale that measures four specific domains of executive functioning: Inhibit Shift, Emotional Control, Working Memory, and Plan/Organize. By using an in-depth observation process, primarily completed by the child's teacher or parent, the BRIEF-P leads to clinical results and a comprehensive profile analysis of a range of behavioral manifestations associated with executive functions. The clinical results obtained from the child's performance allow the examiner to establish associations between the child's behavior and specific domains of executive functions and to design specific interventions at earlier stages of development (Gioia, Espy, & Isquith, 2003).

The increasing movement toward better understanding and awareness of a neuropsychological model to measure an individual's level of executive functioning has been shown across professional literature. A growing body of research supports the neuropsychological model as an explanation for the inconsistent performance of executive functions of preschool children with ASDs and its overall impact on the child's daily functioning (Griffith, et al., 1999; Lord, 1997; Ozonoff, Pennington, & Rogers, 1991; Pennington, Rogers, Bennetto, Griffith, Reed, & Shyu, 1997). The NEPSY-II (Korkman, Kirk, & Kemp, 2007) and the BRIEF-P (Gioia, Espy, & Isquith, 2003) have been employed as reliable measures to distinguish specific patterns of basic neuropsychological functions in preschool-aged children. However, there is still a need for exploring research and comparing neuropsychological patterns of executive functions of preschool children with ASDs. Therefore, the comparison of both empirically-based data and developmentally-based rating scales of executive functions is critical to closely examine the impact on a child's daily functioning in the context of heterogeneous characteristics presented in developmental disorders such as ASDs.

Statement of the Problem

The number of epidemiological studies of ASDs has grown in recent years, including studies aimed at increasing the level of awareness and improving collaboration among families, researchers, educational agencies, and other professionals when dealing with children whose lives are impacted ASDs (Centers for Disease Control and Prevention; Filipek, et al., 1999; Fombonne, 1999). A multidisciplinary consensus panel endorsed by the American Academy of Neurology and Child Neurology Society (Filipek, et al., 1999) reviewed and made recommendations based on the existing research regarding the screening and diagnosis of autism. The panel stated that diagnostic practices require multiple methods employed across multiple settings and should be performed by trained mental health and medical providers. Additionally, the panel emphasized that practitioners need to be familiar with current research-based intervention practices, an essential factor to improve developmental outcomes for young children with autism (Filipek, et al., 1999). In 2001, the National Research Council reiterated the complex nature of the autism diagnosis process, noting that "the level of expertise required for effective diagnosis and assessment of children with autism may require the services of individuals or a team of individuals, other than those traditionally involved" (p. 186).

Recently, an increasing number of research studies in pediatric neuropsychology have shown empirical evidence of deficits of executive functions in young children with autism (Griffith, et al., 1999; Pennington, et al., 1997; Pennington & Ozonoff, 1996). However, empirical interest in the role of complex neuropsychological behaviors-such as executive functions in individuals with autism-traces back more than two decades to earlier research by Damasio and Maurer (1978) and Luria (1966). There have been few studies based on a neurodevelopmental model that explored profiles of executive functions of preschool-aged children with autism. Furthermore, the relationship between neuropsychological instruments and teacher rating scales based on behavioral manifestations has not yet been clearly documented.

Lord (1997) and Ozonoff, Pennington, and Rogers (1991) recommended the use of pediatric neuropsychological instruments for children with autism as an essential component to provide valid and reliable methods of assessment and to ultimately lead to effective intervention practices. Still, school psychologists have limited access to research-based data on the executive function profiles of preschool-aged children with autism. The data obtained from their performance on neuropsychological tests such as NEPSY-II and BRIEF-P would help school psychologists to determine a diagnosis and to take intervention measures. Without access to a comprehensive framework that takes into account the neurological basis and symptomatology of autism disorders, school psychologists may not be able to meet the growing challenges arising from the increased number and wide range of preschool children with autism, nor will they be able to comply with state and federal mandates to develop research-based assessment practices and effective intervention programs (Deisinger, 2001; Filipek et al., 1999; Koegel, Koegel, & Smith, 1997; Volkmar et al., 1999).

Studying and comparing test profiles would enable school psychologists to associate specific executive functions patterns with type and severity of autism, which would lead to improved knowledge and understanding of autism symptoms. Translation of comprehensive assessment processes and empirical data into practical implications for interventions is essential to build a framework that can lead to effective coordination of interventions focused on individual neuropsychological profiles, particularly of executive functions of preschool children with ASDs.

Research Questions and Hypotheses

1. What is the relationship between age of symptoms onset and the age of enrollment in EI services? How is age of symptoms onset related to the intensity of EI services, as defined by the amount of EI services provided from birth to three years of age? The researcher's hypothesis is to accept the null hypothesis for age of symptoms onset and age of enrollment in EI services provided to the child. It was anticipated that no relationship existed between age of symptoms onset and age of enrollment in EI services. Autism, as currently defined by the DSM-IV (American Psychiatric Association, 1994), is diagnosed based on behaviorally observed patterns of delayed developmental milestones, such as communication development, quality of social interaction, and stereotyped and/or repetitive behaviors, and onset occurs before age three. Moreover,

additional research on preschool children with ASDs is warranted to establish a relationship between age of symptoms onset and age that the child received specialized therapy services.

2. What is the relationship between age of symptoms onset and comorbid factors associated with ASDs? The researcher's hypothesis is to accept the null hypothesis for age of symptoms onset and comorbid factors associated with ASDs. Studies of behaviors on children with autism have demonstrated that earlier presentations of characteristics compatible with ASDs are often accompanied by the presentation of comorbid factors (Fombonne, 2003). However, this researcher hypothesized that age of symptoms onset of preschool children presenting with ASDs and comorbid factors (i.e., sleep disturbances, gastrointestinal problems, seizure disorder, sensory integration dysfunction, family background of (ASDs) will not show a significant relationship.

3. What is the relationship between age of enrollment in EI services and the intensity of services provided to the preschool with ASDs and the dependent variables of NEPSY-II Attention and Executive Functioning (ATT/EF); Memory and Learning (ML); Social Perception (SP) domains? The researcher's hypothesis is to accept the null hypothesis. It was hypothesized that age of enrollment in EI services and the intensity of services provided will not have a relationship to the participants' performance on the NEPSY-II (Attention & Executive Functioning;

Memory & Learning; Social Perception). Fombonne (1999) and Volkmar et al. (1994) showed evidence that learning differences have led to increased concerns about the influence of age of symptoms onset and the type of manifestation of ASDs. The researcher will accept the null hypothesis due to the need for additional support to establish a relationship between preschool children with ASDs and scores on the NEPSY-II (Attention & Executive Functioning; Memory & Learning; Social Perception).

4. What is the relationship between age of enrollment in EI services and the intensity of EI services provided to the preschool with ASDs, and the dependent variables on the BRIEF-P (ISCI, FI, & EMI)? The researcher's hypothesis is to accept the null hypothesis. It was hypothesized that age of enrollment in EI services and intensity of services provided will not have a relationship to the participants' performance on the BRIEF-P (ISCI, FI, & EMI) (Mackinlay, Charman & Karmiloff-Smith, 2006).

5. Is there a significant difference between participants' performance on the Attention and Executive Functioning (Att/EF) domain, the Inhibitory Self-Control Index (ISCI), and the Global Executive Composite (GEC)? The researcher will accept the null hypothesis. It was hypothesized that results from Att/EF and the results from ISCI and GEC will not indicate significant differences, which would failure to reject the null hypothesis. The literature does not suggest differences between the participants'

scores on a performance-based measure and his/her teachers' ratings on a test measuring executive functions (Gioia et al., 2002; Korkman, Kirk, & Kemp, 2007; Youngwirth, Harvey, Gates, Hashim, & Friedman-Weieneth, 2007). However, additional information is warranted to establish differences between performance-based measures and teacher rating scales on preschool children with ASDs.

6. Is there a significant difference between participants' performance on the Memory and Learning (ML) domain, the Emergent Metacognitive Index (EMI), and the Global Executive Composite (GEC)? It was hypothesized that results from ML, FI, and GEC will not indicate significant differences, which would failure to reject the null hypothesis. The literature does not suggest differences between the participants' scores on a performance-based measure and his/her teachers' ratings on a test measuring executive functions (Gioia et al., 2002; Korkman, Kirk, & Kemp, 2007; Youngwirth, Harvey, Gates, Hashim, & Friedman-Weieneth, 2007). However, additional information is warranted to establish differences between performance-based measures and teacher rating scales on preschool children with ASDs.

7. Is there a significant difference between participants' performance on the Social Perception (SP) domain, the Flexibility Index (FI), and the Global Executive Composite (GEC)? It was hypothesized that results from SP, FI, and GEC will not indicate significant differences, which

would failure to reject the null hypothesis. The literature does not suggest differences between the participants' scores on a performance-based measure and his/her teachers' ratings on a test measuring executive functions (Gioia et al., 2002; Korkman, Kirk, & Kemp, 2007; Youngwirth, Harvey, Gates, Hashim, & Friedman-Weieneth, 2007). However, additional information is warranted to establish differences between performance-based measures and teacher rating scales on preschool children with ASDs.

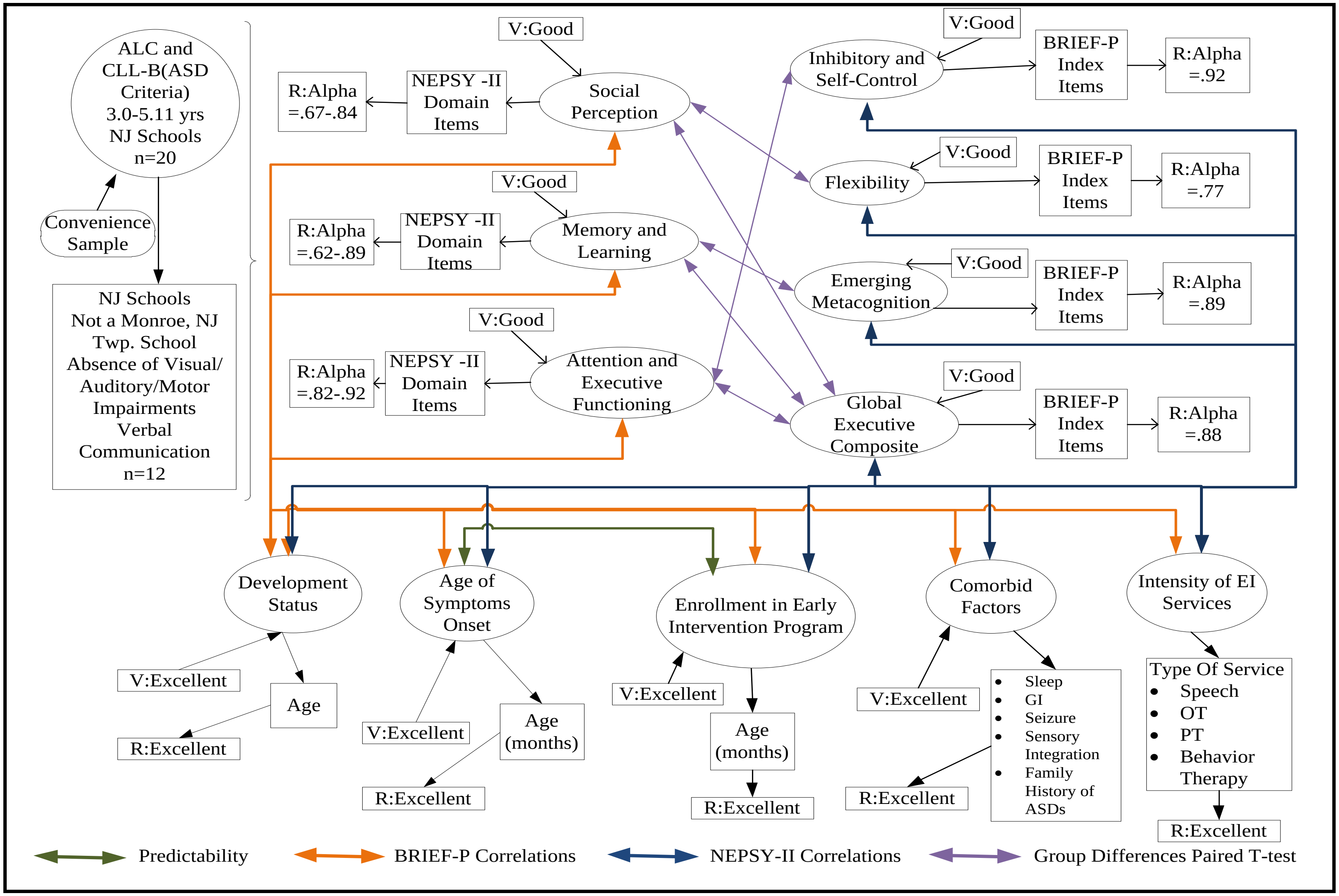

Figure 1. Latent variables of developmental status, age of symptoms onset, enrollment in early intervention program, comorbid factors, and intensity of early intervention services and performance on the NEPSY-II domains and BRIEF-P indexes.

Purpose of the Study

The purpose of this study was to compare specific neurocognitive profiles of preschool-aged children with autism, based on their performance on the Attention and Executive Functioning, the Memory and Learning, and the Social Perception subtests of the NEPSY-II. In addition, this study intends to determine whether age and EI services differentiate performances pertaining learning, particularly executive functions. The study also explored the relationship between the participants' performance on these same subtests of the NEPSY-II and on the teacher ratings of executive functions based on the BRIEF-P.

This investigation will generate awareness regarding the differential performance of preschool children with pervasive developmental disorders. In addition, this investigation will contribute to the development of data that intends to facilitate the incorporation of appropriate and useful assessment measures for identifying the executive function profiles of preschool children with developmental disabilities.

Definition of the Terms

autism. Autism is a developmental disorder of neurological etiology that affects the child's ability to communicate ideas and feelings, use imagination, and establish relationships with others. Autism can also be described as a spectrum disorder, due to the wide range and variety of symptoms and characteristics (National Institute of Mental Health, 2007).

BRIEF-P. The Behavior Rating Inventory of Executive Function-Preschool (BRIEF-P) is a standardized rating scale designed to measure behavioral manifestations of executive function in preschool children. The BRIEF-P is a single form used by parents, teachers, and day care providers to rate a child's executive functions within the context of his or her everyday environments. The BRIEF-P Rating Form consists of 63 items that measure various aspects of executive functioning: inhibit; shift; emotional control; working memory; plan/organize (Gioia, Espy, & Isquith, 2003).

emotional control. Emotional control is the ability to keep emotionally intense stimuli from interfering with mental functioning (Isquith, Gioia, & Espy, 2004).

executive function. Executive function is an umbrella term for functions such as planning, working memory, impulse control, inhibition and mental flexibility, as well as the inhibition and monitoring of action (Hill, 2004).

frontal lobe functioning. The frontal lobes are essential for planning and executing learned and purposeful behaviors; they are also the site of many inhibitory functions (Zelazo, Carter, Reznick, & Frye, 1997).

inhibition. Inhibition refers to the ability to stop one's own behaviors at the appropriate time. Children who display poor inhibition may have an underlying deficit in executive function (Pennington et al., 1997).

NEPSY-Second Edition. The NEPSY: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II) provides a flexible model for evaluating attention/executive functioning, language, visual-spatial processing, sensorimotor functions, memory and learning, and social perception in children ages 3 to 16 (Korkman, Kirk, & Kemp, 2007).

neuropsychological assessment. The neuropsychological assessment consists of a series of clinical procedures and normalized psychological measures that include the measurement of the principal sensory and perceptual functioning, motor functioning, psychomotor problem solving, language and communication skills, and other cognitive skills. Neuropsychological assessments provide information regarding the strengths and weaknesses of the cognitive, sensorimotor, and affective areas. The main purpose of neuropsychological assessments is to establish relationships among the organic integration of the right and the left hemisphere and the adaptive functioning of the child (Korkman, 1999).

organize. The component of organization relates to the ability to bring order to information, actions, or materials to achieve an objective (Isquith, Gioia, & Espy, 2004).

planning. Planning is a complex, dynamic operation in which a sequence of actions must be constantly monitored, re-evaluated, and updated (Hill, 2004).

preschool-aged children. Preschool-aged children range in age from 3.0 to 5.11 years.

preschool child with a disability. According to New Jersey Administrative Code 6A:14: "Preschool child with a disability" corresponds to preschool handicapped and means a child between the ages of 3 and 5 experiencing developmental delay, as measured by appropriate diagnostic instruments and procedures, in one or more of the areas listed below, and the child requires special education and related services. When utilizing a standardized assessment or criterion-referenced measure to determine eligibility, a developmental delay shall mean a 33% delay in one developmental area, or a 25% delay in two or more developmental areas. The developmental areas are:

i. Physical, including gross motor, fine motor, and sensory (vision and hearing);

ii. Cognitive;

iii. Communication;

iv. Social and emotional; and

v. Adaptive.

social perception. Social perception is composed of a complex set of skills necessary for understanding the feelings, perceptions, and intentions of others (Isquith, Gioia, & Espy, 2004).

shift. Shift is the ability to move freely from one situation, activity, or aspect of a problem to another, as the circumstances demand. A disturbance in shift may be manifested by easy distractibility, difficulty in finishing tasks or concentrating on work (Hill, 2004).

Theory of Mind. Theory of Mind refers to the ability to attribute mental stages, such as beliefs, desires, emotions, perceptions, and intentions, to self and others in order to understand and predict behaviors (Baron-Cohen, 1999).

working memory. Working Memory is the ability to hold information in mind for the purpose of completing a task or formulating a response (Isquith, Gioia, & Espy, 2004).

Assumptions

This study assumes that the researcher scoring the NEPSY-II and BRIEF-P was consistent and accurate in following the criteria established in the respective instruments' manuals. The human error presented in the data will be assumed to be part of the randomization process.

This study assumes that the characteristics of the setting in which participants will be tested will not vary significantly across time. Error attributed to the test setting will be assumed to be part of the randomization process.

This study assumes that the current sample of participants is a valid representation of the population characteristics of preschool children diagnosed with ASDs.

This study assumes that the participants will respond appropriately to the test items presented by this evaluator through the test administration.

Limitations of the Study

The present study shares the limitations found in previous studies of autism. The increased interest in the identification of complex psychological processes, particularly executive functions of preschool children, is recent. Therefore, the amount of research related to factors such as the reliability and validity of the neuropsychological tests: NEPSY: A Developmental

Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007), and the Behavior Rating Inventory of Executive Functions-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003) is sparse. Another limitation is the difficulty generalizing the results of the study to other populations. In addition, the present study has not established statistical criteria to control variables like the number and age of the participants. It is essential to develop future research that allows for more control over the mentioned variables in order to establish a database for the neuropsychological instruments and to determine the validity and reliability factors of those instruments for preschool children.

CHAPTER II

LITERATURE REVIEW

Autism: An Overview

Autism is considered the developmental disorder with the most empirically-based research available; the body of research has also generated shared clinical concepts and common language for assessment-intervention practices which are pivotal for clinicians, researchers, parents, and advocates in general (Harris, et al., 1991; Lord, 1997; Pennington & Welsh, 1995). Yet, developing brain-based and developmental methods of assessment for Autism Spectrum Disorders (ASDs) has proven challenging. Given the complexity and heterogeneity of manifested symptoms in ASDs, differentiating ASDs from other common childhood disorders has further delayed and complicated this process. Moreover, research has found that an integrative and comprehensive model for determining one's unique pattern of learning based on a neuropsychological model of assessment may lead to tailored and effective early intervention (EI) practices for young children with the disorder (Filipek, et al., 1999; Hoyson, Jamieson, & Strain, 1984; Lord, 1995; Pennington & Ozonoff, 1996; Joseph, 1999; Stone, 1997). Due to the wide complexity of symptoms and signs that exemplify ASDs, the early identification of core cognitive markers, strengths, and weaknesses may shed light on identifying the clinical etiology of ASDs (Filipek, et al., 1999; Joseph, 1999).

Autism disorder (AD), also known as Autism Spectrum Disorders (ASDs), has been described by a number of mental health researchers and medical practitioners in various ways, depending on the current trends and theoretical models during a particular historical moment. One of the earliest descriptions of ASDs was done by an Austrian-American child psychiatrist, Leo Kanner, in 1943. Kanner first classified the symptoms underlying autism disorder as "autistic disturbances of affective contact" that appeared within the "childhood schizophrenia" concept. This classification appeared in the first (1952) and second (1968) editions of the American Psychiatric Association-Diagnostic and Statistical Manual (DSM). Kanner speculated that early infantile autism was the result of children lacking the typical motivation for social and affective interaction.

While Kanner's clinical observations initiated an intriguing path in children's atypical development, his arguments were refuted and refined by further data that became available during the 1960s. In the early 1950s, a group of clinicians were studying whether the severity of the symptoms presented by young children with autism characteristics was related to earlier characteristics of schizophrenia (Volkmar & Cohen, 1991). In the late 1950s and the early 1960s, etiology research emphasized categorical and cognitive processes rather than deficient parent-child interactions, not early schizophrenia as causes of autism disorder (Volkmar & Cohen, 1991). During the 1970s, researchers concentrated on the relationship of autism characteristics and onset, genetic components, as well as cognitive patterns.

The DSM-III (1980) introduced the newly-coined term Pervasive Developmental Disorders (PDDs), which was designated to include childhood onset disorders and other areas of the child's development (Gillberg, 1991). The term was meant to avoid the controversy related to prior associations of autism disorder and early development of schizophrenia.

The DSM-III-R (1987) further changed the diagnostic concept of AD; essentially autism became a broader view of the diagnostic concept of the American Psychiatry Association (1987). DSM-III-R added specific patterns of the three major domains established by DSM, adding specific patterns to each domain: qualitative impairment in reciprocal social interaction, qualitative impairment in verbal and nonverbal communication and imagination, and a restricted repertoire of activities and interests. Another change in the DSM-III-R was the emphasis on the manifestation of "autism-like" characteristics based on age and developmental levels. Volkmar, et al. (1994) argued that one of the major advances in the criteria for autism disorder was that once the characteristics of the disorder manifested during childhood, the diagnosis was assumed to similarly manifest such behavioral characteristics in a homogeneous manner.

The DSM-IV (1994) cited 21 field trials in support of improved criteria for autism related to age of onset and for a multidimensional model (Volkmar, Chawarska, & Klin 2005). The field studies cited in DSM-IV demonstrated the need for modifying the diagnostic criteria, which resulted in balanced coverage of the range of characteristics manifested over the full lifespan from early childhood through adulthood. The DSM-IV (APA, 1994) replaced its general category of autism by including a number of specific conditions, such as Rett's Disorder, Childhood Disintegrative Disorder (CDD), Asperger's Disorder, and Atypical Autism or Pervasive Developmental Disorders-Not Otherwise Specified (PDD-NOS) in their diagnostic system (Gillberg, 1991). The most recent edition, the DSM-IV-TR (APA, 2004), uses the main heading "Pervasive Developmental Disorders," which covers the constellation of characteristics under Autistic Disorder (AD) or ASDs. The DSM-IV-TR (APA, 2004) retains the same criteria and subtype classifications as those in the DSM-IV, but it includes criteria for impairments in social interaction and repetitive and stereotyped patterns of activities.

The modifications of the diagnostic criteria over the years illustrate the difficulty in defining a heterogeneous and complex group of brain-related behaviors exhibited by individuals with autism. The many changes and attempts at qualitatively defining subtypes have been the subject of increasing discussion and controversy, particularly around the issues related to variables such as age, developmental level, and cognitive patterns of strengths and weaknesses (Lord, 1995; Rogers, 1998). The DSM has been criticized for reliance on the multiaxial model to understanding childhood disorders, requiring consistency and impact across different dimensions of development, which may have increased the child's vulnerability towards other developmental difficulties (Volkmar, et al., 1994).

Even though the DSM-IV-TR classification system represents a breakthrough in the development of autism disorder criteria and subtypes, it is not the most broadly accepted set of criteria, and it is still controversial. Researchers and educators are still attempting to identify and to develop effective interventions for the broad complexity of cognitive and behavioral issues manifested in ASDs (Lord, 1995; Rogers, 1998; Rutter, 2000).

Autism disorder, as currently defined by the DSM-IV-TR (American Psychiatric Association, 2004), is diagnosed using behaviorally-observed patterns of delayed developmental milestones, such as communication development, quality of social interaction, and stereotyped and/or repetitive behaviors, and onset before age three. The DSM IV-TR defines five subtypes of ASDs: Autistic Disorder, Asperger's Disorder, Pervasive Developmental Disorders-Not Otherwise Specified, Rett's Disorder, and Childhood Disintegrative Disorder. Although ASDs are also used synonymously with Pervasive Developmental Disorders, both are listed as separate diagnostic categories. For the purpose of this literature review, the term ASDs will be used as it emphasizes the common "autism-like" characteristics that are manifested across all of these specific diagnoses (CDC, 2007; NIMH, 2007). The DSM-IV-TR (2004) places autism in a category referred to as pervasive developmental disorders, which states that "all of these disorders are characterized by ongoing problems with mutual social interaction and communication, or the presence of strange, repetitive behaviors, interests, and activities."

Although the current guidelines used to identify children with autism (APA, 2004) represent a consensus view regarding diagnosis, the guidelines constitute a categorical description of a complex brain-based disorder. Several researchers (e.g., Minshew, et al., 1997; Lord, 1997) questioned the guidelines and argued that a categorical definition is insufficient. Critics indicated that marked emphasis on categorical definitions of autism overlooked critical developmental considerations and possibly led to an inaccurate diagnosis of the disorder, consequently impacting overall developmental outcomes. Simultaneously, significant progress has been made toward an understanding of the wide range of symptoms manifested within ASDs (Volkmar, et al., 1999).

Identification Issues: DSM-IV vs. IDEIA Criteria

The concept of diagnosis vs. eligibility process of children with ASDs represents a puzzle for many parents and educators concerned with the child's progress. Currently, parents and primary health care physicians are the first individuals to report early behavioral symptoms of developmental delays such as ASDs. Filipek, et al. (1999) indicates that while early symptoms of ASDs are apparent by the age of 12-18 months, most children are not diagnosed until later in their childhood. Certainly, those children who present with more severe communication and social challenges will be identified earlier by their caregivers and physicians. Furthermore, Filipek, et al. explained that many parents and physicians may delay early identification due to misconceptions of the significance of diagnosis vs. eligibility process, which ultimately delays the provision of intervention services during critical stages of early childhood.

Currently, the diagnosis of pervasive developmental disorders includes "autism-like" characteristics outlined by the DSM-IV-TR based on a set of behavioral symptoms exhibited by the child. Initially, during the identification process, medical practitioners, including neurologists, pediatricians, and psychiatrists, consider other biological risk factors, including family history of other individuals with ASDs (CDC, 2007; Ritvo, Freeman, Pingree, & Mason-Brothers, 1989) and medical conditions (e.g., Fragile X, tuberous sclerosis, neurofibromatosis); which have been linked to increased chances of ASDs (Muhle, Trentacoste, Rapin, 2004; Rutter, 2000). In contrast, the concept of eligibility criteria results from a data-gathering process in the public school system to determine the need for special education and related services for the child exhibiting "autism-like" tendencies. The Individuals with Disabilities Education Improvement Act (IDEIA, 2004) became a federal law; which mandates education and intervention services for individuals with disabilities from birth to age 22 years. IDEIA defined the eligibility criteria of "autism" as a disability that affects communication and social interaction, as well as associated characteristics such as repetitive activities, stereotyped movements, resistance to change, and unusual sensory responses which adversely impact a child's educational performance. IDEIA-2004 mandates that school professionals conduct comprehensive and specialized assessments in order to identify brain-based developmental disabilities at an early stage and provide in-depth information about a child's profile of strengths and weaknesses.

Currently, IDEIA-2004 mandates the use of research-based methods throughout special education practices, including at-risk identification and assessment and intervention services for children requiring specialized programs. Deisinger (2001) and Filipek, et al. (1999) argued that while school psychologists have traditionally employed a problem-solving model characterized by a variety of standardized measures and techniques, their professional roles may require adaptations and modifications in order to keep abreast of research-based strategies for children receiving specialized instruction. Filipek, et al. (1999) documented the increased interest by school psychologists in adopting brain-based principles and practices throughout special education. Today, school professionals recognize the importance of adopting a neuropsychological perspective as a critical component to understanding brain-behavior relationships in order to develop high quality assessment and interventions based on brain-behavior analyses (Joseph, 1999; Minshew, et al., 1997; Pennington & Ozonoff, 1996). Interestingly, the use of a neuropsychological model for the assessment of children with neuropsychological disorders is aligned with current educational regulations including the No Child Left Behind Act of 2001 (NCLB-2001) and IDEIA-2004.

The increased awareness of developmental disorders, such as ASDs, resulted in the need for research-based assessment and interventions in order to improve the overall outcome of treating individuals with life-long disorders. As mandated by Child Find regulations, school psychologists involved in preschool programs play a critical role in case finding, which is designated to recognize the presence of risk factors and warning signs and the need for further assessment (Filipek, et al., 1999; Volkmar, Cook, Pomeroy, Realmuto, & Tanguay, 1999). Furthermore, Filipek, et al. emphasized that all school psychologists should participate in not only screening and assessment practices with valid and reliable instruments for ASDs and other developmental disabilities, but also the coordination and implementation of research-based interventions for individuals displaying warning signs of ASDs and other developmental disabilities.

Given the research trends and changes in approaches toward the assessment process, current practices require a comprehensive and integrative approach, specifically a neuropsychological model to understand symptoms associated with the wide range of ASDs characteristics. Thus, the National Research Council (2001) indicated that: "The level of expertise required for effective diagnosis and assessment may require services of individuals, other than those with typical professional requirements" (p. 186).

President George W. Bush signed The Combating Autism Act (2006), which aimed to increase public awareness about autism disorder and to provide enhanced federal support for autism research and treatment. The act was designed to facilitate the integration of public sector members (e.g., doctors, parents, educators, and educational agencies) interested in autism in an attempt to improve and develop better practices that were critical to early identification, implementation of interventions, and support for individuals with the disorder. The act emphasized the need for school psychologists to shift their responsibilities from traditional assessment practices to an integrative and systematic assessment process of brain-behavior relationships, which would ultimately translate into the implementation of individualized and functional treatment recommendations for individuals with autism.

The roles and parameters of the school psychologist, when engaging in assessment practices, go beyond the establishment of a cognitive profile (Deisinger, 2001; Filipek, et al., 1999; Koegel, Koegel, & Smith, 1997). Rather, they involve a comprehensive approach of determining strengths and weaknesses of the child with autism. Given the nature of the core symptoms of ASDs and the implications for educational planning, school psychologists should consider a neuropsychological model to describe the profile of each preschool-aged student diagnosed with brain-based disorders such as autism. Creating in-depth descriptions are pivotal baseline steps in determining optimal intervention strategies based on individual learning patterns for preschool children with autism. Thus, researchers highlight the importance for school psychologists to advocate and to ensure the use of effective assessment methods to identify specific neuropsychological patterns of strengths and weaknesses in preschool-aged children with ASDs (Diamond & Gilbert, 1989; Isquith, Crawford, Espy, & Gioia, 2005).

Incidence and Prevalence Rates

In an effort to collect relevant information on the relationship between ASDs and educational expectations, the Individuals with Disabilities Education Act, 2004 (IDEIA, 2004) requires each state's local educational agency (LEA) and the U. S. Department of Education to obtain data on specific childhood disabilities, such as autism, during each academic year. IDEIA's data analysis process aims to determine the incidence and prevalence of ASDs among children ages 3-21 by examining cases currently eligible under the disabling condition of autism and receiving special education and related services as per state and federal regulations. However, there are groups of children with the autism diagnosis that are not reported, such as children who are enrolled in private schools or being home schooled, or who do not meet the eligibility criteria of autism, or who are enrolled in regular education programs without supplementary services (IDEIA-DANS, 2007). Therefore, both the incidence of children with autism—which refers to the annual diagnosis rate or the number of new cases of autism per year—and the prevalence of children with autism—which refers to the estimated amount of individuals who currently are dealing with the manifestations of autism disorder—appears to be underestimated by the states' LEAs and the U.S. Department of Education. The first study commissioned by IDEIA-DANS found that in the U. S., over 35,000 preschool-aged children with a diagnosis of autism were entitled to receive special education services in the 2005-2006 school year, when compared to 20,000 (2003-2004 school year) and 15,000 (2000-2001 school year) preschool children with autism (IDEIA-DANS, 2007). Between 1994 and 2006, the estimated incidence of children classified with autism in public school special education programs increased from 22,664 to 211,610, thus becoming the second most common developmental disability that negatively impacts children's development, surpassing all other developmental disabilities, including speech and language delays, learning disabilities, and attention deficit hyperactivity disorders (NIMH, 2007).

In 2007, the CDC and the National Institute of Mental Health (NIMH) documented that, while a higher incidence of autism seems to be systemic across the U.S., it still remains difficult to determine if the increased incidence is due in part to variables such as earlier identification at which the child first exhibits autism and the complexity of the symptoms. For many decades, autism was considered to be a rare childhood disorder, with its prevalence rate reported between 0.1 to 0.2% of developmental disabilities in children (Gillberg & Wing, 1999). During the early 1990s, the prevalence of autism was estimated between 0.5 to 1%; however, Gillberg and Wing (1999) argued that autism prevalence is believed to be much higher due to the heterogenic nature of "autism-like" symptoms.

Recently updated epidemiological studies have predicted that the prevalence of ASDs is approximately 1 in 150 children under the age of three born in the U.S. (CDC, 2007). The increased rate of children with ASDs became visible after the first multi-states' collaborative study designed to monitor the prevalence and incidence of autism in the United States. The collaborative study, done by the CDC, revealed that New Jersey was the state with the highest prevalence of children with autism disorder. New Jersey reported a rate of 1 in 95 children when compared to the other 14 states which were part of the collaborative study. The data suggested that the trend of increasing prevalence of ASDs also exists within special education programs (Bertrand, Mars, Boyle, Bove, & Yeargin-Allsopp, 2001).

The increase in prevalence is further supported by Kohrt (2004), who reported that 95% of school psychologists indicated a dramatic increase in the number of students with ASDs on their caseloads. Consistently, research studies of ASDs stressed the need for accurate and research-based interventions for the complex and diverse learning profiles of children with ASDs, as well as improved assessment practices to enhance the existing coordination process of specialized interventions, thereby maximizing their potential across all developmental components (Fombonne, 2003).

Developmental Factors: Age of Symptoms Onset

Research suggests that symptoms of ASDs manifest differently depending on a number of factors, such as age of symptoms onset and developmental level. Symptoms of ASDs have been reported to be noticeable to parents and/or caregivers beginning in the early infant and toddler years (Filipek et al., 1999). A variety of sources—such as empirical data gathered through direct assessment, observations, videos, interviews, and questionnaires—support that early onset of symptoms is most clearly related to autism severity as validated by measures given to young children with autism. Short and Schopler (1988) documented that 66% of children with autism were identified by their parents or caregivers by 24 months of age, and 94% by 36 months of age. Baron-Cohen and colleagues (1996) studied toddlers who failed to demonstrate pretend play, gaze-monitoring, and intentional pointing by 18 months of age and were considered at-risk for receiving a diagnosis of autism. Baron-Cohen found that 10 out of 12 toddlers, who failed to demonstrate typical characteristics, were later diagnosed with autism; the same 10 toddlers were re-assessed at 3.5 years of age, and their diagnosis remained the same. Baron-Cohen concluded that failure to demonstrate pretend play, gaze-monitoring, and intentional pointing by age 18 months were risk factors for autism.

Similarly, other researchers (Dawson et al., 1998) found that difficulties in the social domain, such as poor eye contact, failure to engage in imitative games, and lack of imitative vocal responses by 12 months of age are important risk factors for autism. To summarize, in the studies examined, chronological age and age of symptoms onset seem to be factors influencing the manifestation of symptoms of ASDs. Therefore, age of onset and developmental level are considered significant factors for referral age, and eventually for quality of intervention outcome for children with ASDs.

Autism: Sex Ratio

One of the most remarkable findings about individuals with autism is the disproportionate sex ratio. Epidemiological and clinical-based studies completed by Fombonne (1999) reported that the number of males diagnosed with ASDs is four to five times greater than that of females. Moreover, Volkmar, et al. (1994) found that when females are diagnosed with ASDs, they are typically more severely impacted and exhibit more cognitive deficits. In particular, research supports significant sex differences in several well-defined characteristics, such as stereotyped movements among children with ASDs (Fombonne, 1999).

In regard to performance-based measures of executive functions and sex differences, research evidence is limited, particularly in the preschool population. A study by Klenberg, Korkman, and Lahti-Nuuttila (2001) of the developmental sequence of Att/EF in children aged 3-12—including data from 10 NEPSY subtests measuring impulse control and inhibition of irrelevant responses, auditory and visual attention, visual search, planning, and verbal and visual fluency—revealed a significant relationship between sex and development. While the Klenberg, Korkman, and Lahti-Nuuttila study did not explicitly report sex differences, it showed that girls in the age group 3-5 made fewer mistakes and performed better than boys on the Visual Attention subtest. The evidence of sex differences in existing studies led to increased concerns about the influences of sex on the type and manifestations of ASDs (Volkmar, et al., 1994).

Autism: Genetic Influences

Research in genetic factors and ASDs has increased over the last twenty years (Fombonne, 2003; Ritvo, Freeman, Pingree, & Mason-Brothers, 1989). According to the CDC, parents who have a child with ASDs have a 2 to 8% higher probability of having a second child with similar manifestations of ASDs (CDC, 2007). Ritvo and colleagues (1989) conducted an epidemiologic survey of 207 families of children with autism and found that 9.7% of the families had more than one child with autism, which supports previous findings that there may be a genetic subtype of autism. Muhle, Trentacoste, and Rapin (2004) provided research findings suggesting that children with dysmorphic features, congenital abnormalities, mental retardation, or family members with developmental disorders, are those most likely to receive genetic counseling. Although a number of genetic epidemiological studies investigating the relationship between genetic influences and ASDs has been completed, a direct relationship between behavior and genetic factors is still nonexistent, genetic factors have not yet been found to be an influence on diagnostic or intervention practices.

Autism: Socioeconomic Status (SES) and Ethnicity Factors

When Kanner (1943) initially identified children with autism, he noted that most cases came from families of high education and socioeconomic status, which gave the mistaken impression that autism was exclusive to such families. Additional studies revealed evidence that ASDs affect individuals from all ethnic and socioeconomic backgrounds (Bertrand et al., 2001) and that earlier impressions of Kanner's original cases resulted from biased studies, as families with higher education and socioeconomic backgrounds referred their children earlier than families from other ethnic and educational and professional backgrounds. A recent literature review completed by Dyches and colleagues (2004) found differences in prevalence across races for autism, but found little information regarding multicultural families' adaption in raising a child with autism.

Similarly, Mandell, Listerud, and Pinto-Martin (2002) reported racial differences in the age at which Medicaid-eligible children first received a diagnosis of ASDs and the time spent in mental health screening until diagnosis was received. Mandell and colleagues studied 406 children, who received services for a diagnosis of ASDs and concluded that white children received a diagnosis of ASDs, at 6.3 years of age, compared with 7.9 years for black children ($p < .001$). Also, white children entered the mental health screening process at an earlier age (6.0 vs. 7.1 years; $p = .005$). This study gathered evidence that showed discrepancies in the early detection and treatment of autism based on racial background. Yet, DeGiacomo and Fombonne (1998), in a study of the association of early identification and age of referral, found no relationship between socio-economic or ethnic background and early identification and diagnosis. Moreover, Fombonne (1999) conducted an epidemiological study with 1,533 participants diagnosed with pervasive developmental disorders and concluded that social class or immigrant status did not affect the early identification and diagnosis of ASDs.

Influence of Comorbid Factors

Autism has been found to appear together with a range of other diseases and conditions (Muhle, Trentacoste, & Rapin, 2004). Rutter (2000) noted a high proportion of children presenting with ASDs, as well as other medical conditions and cytogenetic abnormalities, such as tuberous sclerosis and Fragile X syndrome, which account for 10% of children with ASDs. Comorbidity studies revealed that the other medical conditions, occurred at higher rates in children diagnosed with ASDs. Tuchman and Rapin (2002) found that 3 to 30% of children with ASDs also suffered from epilepsy. Tuchman and Rapin raised the possibility that some epilepsy cases presented with covert symptoms, were difficult to detect by observation, and yielded an electroencephalogram with abnormalities in the absence of a seizure disorder.

Fombonne (2003) found that about 70% of children with autism have cognitive impairments; about a third fall in the mild range of cognitive impairments, and more than a third (40%) fall within the severe to profound range of mental retardation. Moreover, cognitive skills in individuals with autism may show uneven development, with a high discrepancy among skills, such as marked delays in verbal skills and average or above average spatial or visual motor skills. Fombonne (2003) added that a diagnosis of autism in children with severe cognitive impairments must be analyzed with caution because repetitive behaviors and unevenly developed skills often associated with autism may also be found in children with cognitive impairments, but does not necessarily indicate ASDs.

Bruin, Ferdinand, Meester, Nijs, and Verheij (2007) investigated the prevalence of comorbid psychiatric disorders, such as Disruptive Behavior Disorder and Anxiety Disorder, in 94 children aged 9-12 years who had been diagnosed with PDD-NOS. The study showed that 80.9% of children diagnosed with PDD-NOS had at least one comorbid psychiatric disorder. Specifically, 61.7% of children with ASDs had a comorbid disruptive behavior disorder, and 55.3% satisfied the criteria for anxiety disorder. These results supported previous evidence that showed a relationship between comorbid disorders in ASDs, particularly PDD-NOS.

A review of the literature completed by Erickson, Drevets, and Schulkin (2005) found very few studies of associations between ASDs and gastrointestinal conditions. The authors concluded that there was little evidence to suggest that individuals with autism were prone to gastrointestinal symptoms such as diarrhea, constipation, or food intolerance. In a more recent study review, Nikolov, et al. (2009) evaluated gastrointestinal (GI) problems in a large, well-characterized sample of children with pervasive developmental disorders (PDD). In this study, 172 children entering one of two trials conducted by the Research Units on Pediatric Psychopharmacology Autism Network were assessed comprehensively prior to starting treatment and were classified with regard to GI symptoms.

Nikolov and colleagues found that 39 children (22.7%) had GI problems, primarily constipation and diarrhea concurrent with PDD symptoms. Those with GI problems were no different from subjects without GI problems in demographic characteristics, measures of adaptive functioning, or autism symptom severity. However, those with GI problems showed greater symptom severity on measures of irritability, anxiety, and social withdrawal. Lastly, those with GI problems were less likely to respond to treatment.

Hansen and Hagerman (2003) recommended a complete medical history with an emphasis on medical conditions known to be related to autism, which might include immune dysfunction (e.g., frequent infections), autoimmune disorders (e.g., thyroid problems, arthritis), allergy history (e.g., foods or environmental triggers), and gastrointestinal symptoms (e.g., diarrhea, constipation, bloating). Moreover, a comprehensive diagnostic history should screen for related neurological and/or general medical conditions such as seizures, encephalitis, phenylketonuria, tuberous sclerosis, and Fragile X syndrome.

Neuropsychology Trends and ASDs

Despite controversial aspects of diagnostic criteria and models related to the etiology of ASDs, autism specialists have agreed that early detection and EI do lead to meaningful outcomes for children with ASDs (Harris, et al., 1991; Harris & Handleman, 2000; Hoyson, Jamieson, & Strain, 1984; Lovaas, 1987; Rogers & Lewis, 1989). Consequently, health care professionals, parents, and school professionals are faced with the task of improving autism-specific screening practices that could lead to early identification of at-risk children and, equally important, initiating intensive EI services during the preschool years. Awareness and improved diagnostic practices have led to better coordination of EI services, which have resulted in positive interventions and improved long-term prognosis for children with autism (Rogers, 1998).

The field of neuropsychology offered a comprehensive and accurate model for the diagnosis and treatment of autism disorders. During the last two decades, studies on the etiology of autism considered the emerging neuropsychological perspective as a framework to explain complex processes of neurological basis. A number of neuropsychological explanations have described the complexity of autism disorder in children (Pennington & Ozonoff, 1996). Minshew, et al., (1997) and Volkmar, Chawarska, and Klin (2005) described autism as a neurodevelopmental syndrome characterized by social dysfunction, communication delays, and complex reasoning difficulties. The relationship between atypical brain behavior and autism suggested that abnormalities in the brain structures may be contributing factors to incomplete neural development, which may explain deficits in social-emotional, motor, language, and overall cognitive development in children with autism disorder (Bachevalier, 2000; Baron-Cohen, et al., 1996, 2000; Volkmar, Chawarska, & Klin, 2005).

The diagnostic process is further complicated by the difficulty in differentiating the wide range of symptoms of ASDs from other developmental disorders (Sparrow et al., 1997; Volkmar et al., 1994). Even though specialists relied on behavior- or diagnostic-based criteria currently in place, during the last two decades ASDs received attention as a complex neuropsychological disorder (Joseph, 1999). A neuropsychological model exploring the complexity of ASDs has been supported (Lord, 1997; Sparrow, et al., 1997) as a systematic perspective to establish a profile of strengths and weaknesses in the child's learning process. A systematic categorization of psychological functions in children with ASDs provides a theoretical framework to understand the behavioral and neuropsychological dimensions of the disorder. Also, it may contribute to the planning, coordination, and implementation of intensive research-based interventions based on each child's profile of learning and adaptive functioning.

Presently, most researched neuropsychological studies account for the wide range of manifestations that characterize ASDs. A neuropsychological model represents cognitive and developmental views of the disorder and leads to a better understanding of social-cognitive and perceptual-cognitive models to explain or predict a number of manifestations of ASDs (Filipek, et al., 1999; Hoyson, Jamieson, & Strain, 1984; Lovaas, 1987; Harris, et al., 1991; Lord, 1997; Volkmar, et al., 1994). For instance, some of the neuropsychological models attribute "autism-like" characteristics to specific skills such as sensory-perception, attention, memory, and executive functions (Joseph, 1999; Pennington & Ozonoff, 1996; Volkmar et al., 1994). Different neuropsychological models provide different explanations of "autism-like" behaviors and different subtypes of ASDs. Neuropsychological models differ in their specific components, but they share fundamental characteristics to support the critical aspects of brain-behavior relationships (Joseph, 1999; Rogers & Lewis, 1989).

Identifying early cognitive processes in young children becomes crucial in understanding essential aspects—such as type and severity—of autism and the development of future interventions. Damasio and Maurer (1978) were the first to propose relationships between stereotyped and repetitive behaviors and executive dysfunction as a theoretical explanation for localized neurological deficits, particularly those deficits associated with frontal lobe injuries and other impairments that affect executive skills. A growing body of research cited a strong relationship between executive dysfunction and autism disorder (Minshew, et al., 1997; Pennington & Ozonoff, 1996; Pennington, et al., 1997; Volkmar, Chawarska, & Klin, 2005).

Traditionally, research has indicated that executive functions emerge during later childhood stages (Diamond & Doar, 1989). More recent data from anecdotal and empirical research strongly suggested that development of executive control occurs during earlier stages of human development, specifically during infancy and preschool years (Dawson, Meltzoff, Osterling, & Rinaldi, 1998; Griffith et al., 1999; Hughes, 1996; McEvoy, Rogers, & Pennington, 1993). The research indicated that frontal lobe development starts during early infancy years, challenging initial studies that restricted the emergence of executive skills to processes that occur later in children's development.

Researchers studying the effects of autism and the deficits of complex neuropsychological functions proposed an executive functions model to help understand cognitive deficits in individuals with ASDs (Pennington & Ozonoff, 1996; Pennington, et al., 1997; Rogers, 1998). There was only a limited amount of research, however, that considered the relationship between preschool children with ASDs and executive functions, which begin to develop during the first years of life (Burgess et al., 1998; Denckla, 1996; Isquith et al., 2005). Therefore, the study of executive functioning profiles of young children with developmental disabilities should be expanded beyond the identification of communication, social, and behavioral symptoms.

While many theories related to the etiology of ASDs are discussed across literature, the most recent cognitive and neuropsychological models have been recognized as a comprehensive explanation for many of the complex behaviors observed in individuals with autism (Espy, et al., 1999; Griffith, et al., 1999; Isquith, et al., 2005; Ozonoff, Pennington, & Rogers, 1998; Zelazo, Carter, Reznick, & Frye, 1997). Typically, executive functions (EF) refer to cognitive and behavioral characteristics required to accomplish a given task (Denckla, 1996). Commonly used terms in executive functions theory include cognitive flexibility, goal selection, planning, monitoring, feedback use, problem solving, formulation of abstract concepts, self-control, and self-consciousness (Pennington, Ozonoff, & Rogers, 1991), among many others.

One of the most accepted conceptual definitions of EF views executive functions as "a general umbrella construct referring to the control, supervisory, or self-regulatory functions that organize and direct all cognitive activity, emotional response, and overt behavior" (Welsh & Pennington, 1988, p. 201). Rimland (1964) was one of the first researchers to document the relationship between autism and brain-based deficits.

Earlier studies considered ASDs as one extensive set of impaired neural pathways presenting with dysfunctional information processing of behavior and cognition in young children (Rimland, 1964). Since then, many authors documented the complexity and wide range of deficits in pragmatic language, communication abilities, social awareness, executive functions, and affective processing in individuals identified as presenting with autism (Joseph, 1999; Pennington & Welsh, 1995).

Today, a growing body of research illustrates areas where findings converge with the theory that a complex group of brain structures is associated with human behaviors, such as social relationships, language, motor activity, and behavioral responses (Joseph, 1999; Pennington & Welsh, 1995). Different executive functions have been attributed to different regions of the frontal structures of the brain (Gioia, et al., 2002; Pennington & Ozonoff, 1996). Welsh and Pennington's (1988) pragmatic description was further explained by the model of prefrontal functions provided by Fuster (2000). Fuster showed that three major mechanisms are mediated by different centers within the prefrontal cortex: a temporally retrospective function of working memory, a temporally prospective function of anticipatory set, and an interference-control mechanism that suppresses behavior incompatible with the current goal. The research supported that two cognitive processes (i.e., working memory and inhibition) may account for the characterization of the domain of EF (Pennington, 1991). For instance, researchers (Roberts & Pennington, 1996) have documented that many of the frequently used EF tasks appear to require both working memory and inhibition, and these two processes characterize executive functions mediated by the prefrontal cortex.

Neuro-behavioral Profiles during Early Childhood Years

Executive functions are essential in the development of a child's cognitive, behavioral, and social-emotional skills, and they impact overall academic and social functioning. It is imperative that mental health professionals acknowledge the role of executive functions in preschool children with complex neuro-behavioral profiles, such as children with ASDs, and are aware of the educational and social implications of executive function difficulties. Studies have shown a strong relationship between the emergence of EF during the first years of life and adaptive learning and social-emotional factors later in the child's development (Denckla, 1996; Hughes, & Graham, 2002; Pennington & Ozonoff, 1996).

Conceptually, EF has been investigated over the past 20 years (Denckla, 1996) from different theoretical models, leading to a vast number of definitions.

Denckla explained that EF can be better understood as an integrated directive system exerting regulatory control over basic, domain specific neuropsychological functions (language, visual-spatial functions, memory, emotional experience, and motor skills). Similarly, Welsh and Pennington (1988) provided a pragmatic definition of EF as "the ability to adopt and maintain an appropriate problem-solving set for attainment of a future goal" (p. 101). Additionally, Welsh and Pennington (1988) described three major mechanisms governed by many executive functions: (a) an intention to inhibit a response or to defer it to a later more appropriate time; (b) a strategic plan of action sequences; and (c) a mental representation of the task including the relevant stimulus information encoded into memory and desired future goal-state.

There is increasing empirical support that the EF construct is useful in understanding child development. Research suggests that some EF emerge around the first year of life and they continue to develop across the ages, with crucial changes occurring between 2-5 years of age (Denckla, 1996; Fuster, 2000). Vig and Jedrysek (1999) showed increased interest in preschool children and manifestations of ASDs, particularly in behaviors including joint attention, which may start to be observed during early childhood. Vig and Jedrysek explained that joint attention refers to the individual's ability to direct his or her attention toward an object, person, or event for the purpose of sharing his or her interest with someone else. Bertrand and colleagues (2001) proposed that factors associated with attention problems reflect problems in social engagement and are the strongest early markers of pervasive developmental disorders.

Fuster (2000) reviewed current perspectives of the development of executive functions, and postulated that they are relatively immature during childhood, with staggered development that emerges during the early first years of life and continues throughout childhood and the adolescent years. In the past, EF were viewed as exclusive abstract or high-level thought processes that were manifested after adolescence. Recent research has provided evidence that such skills can be observed in early childhood (Denckla, 1996; Hughes & Graham, 2002; Zelazo, Carter, Reznick, & Frye, 1997). Dennis (1991) outlined three periods of early EF development in childhood, including an emerging period (an acquisition period, not mature skills), a developing period (abilities are acquired, but immature skills), and an acquired period (mature and functional skills).

Role of Executive Functions

The research literature documented an increased interest in studying the essential role of deficits in various aspects of EF and the relationship of these deficits with many acquired and developmental disorders (Gioia, et al., 2002; Gioia & Isquith, 2004; Pennington & Ozonoff, 1996). Executive functions are considered critical in the development of neuropsychological functions, thus playing a fundamental role in the child's cognitive, behavioral, and social-emotional development (Isquith, Crawford, Espy, & Gioia, 2005). As such, this provides an explanation for an increase in the research literature over the past two decades dedicated to the study of typical and atypical development of EF in preschool children.

The present study adopts the descriptions of executive functions provided by Gioia and Isquith (2004). The authors defined executive functions as “a collection of related yet distinct abilities that provide for intentional, goal-directed, problem-solving action, which are characterized by sub-domains that organize and direct all cognitive activity, emotional response, and overt behavior” (Gioia & Isquith, 2004, p. 138). Gioia and Isquith’s model of executive functions identifies specific behaviorally-referenced sub-domains that make up this collection of regulatory functions, including the ability to initiate, inhibit, set and maintain goals, plan, organize, self-monitor and evaluate, solve problems, be flexible, and shift between cognitive and emotional skills (Gioia & Isquith, 2004).

Components of an Executive Functions Model

Models of EF and its components (Denckla, 1996; Gioia & Isquith, 2004; Hughes, 1996) have contributed to a better understanding of the development of these neurocognitive skills in children with ASDs (Isquith, Crawford, Espy, & Gioia, 2005; Sparrow, 1997). Specifically, Gioia and Isquith (2004) referred to executive functions as a set of executive sub-domains, which include cognitive flexibility, response inhibition, self-monitoring, and organizing and planning abilities. Even though Gioia and Isquith defined the role that executive sub-domains play in ASDs, the relevance and interaction among those mental operations have been scarcely postulated, given the heterogeneous etiology and wide array of symptoms associated with ASDs (Hughes, 1996; Pennington & Ozonoff, 1996; Volkmar, Chawarska, & Klin, 2005).

Gioia and Isquith (2004) asserted that working memory is a fundamental component of executive sub-domains, which is defined as the capacity to hold information actively "on-line." Gioia and Isquith (2004) proposed that emotional responses and control are fundamental to successfully problem-solve a given activity.

In support of the brain structures and executive functions model, Loveland (1991) stated that children with ASDs are impaired not only in understanding others' mental states, but also in self-regulation of social-emotional behavior. Therefore, a model of brain development to understand autism must encompass not only those brain systems that facilitate social-cognitive and emotional functioning, but also those that sustain the self-regulation of behaviors in response to a changing social environment. Pennington and Ozonoff (1996) and Welsh, Pennington, Ozonoff, Rouse, and McCabe (1990) posited that the core defining autism triad, communication, social, and restricted and repetitive interests and behaviors, are correlated with a complex group of brain structures located in the pre-frontal portion of the brain. These areas are implicated in difficulties related to social relationships, motor activity, and behavioral responses. Traditionally, executive functions were viewed as emerging only in later childhood; however, a growing body of research documented the development of executive function processes during infancy and the preschool years (Diamond & Doar, 1989;

Denckla, 1994; Hughes, 1996; Stone, 1997). The following will examine these executive sub-domains and their relationship with preschool children's development.

Organization and planning components involve the ability to anticipate future events, develop appropriate steps to carry out a task, and bring order to information (Denckla, 1996). Hill (2004) noted that the organizing and planning sub-domain includes complex operations that require constant monitoring, evaluating, and updating of current actions. Hill described planning as "a complex and dynamic mental operation in which a sequence of planned actions must be constantly monitored, re-evaluated and updated." (p. 26). This requires the conceptualizing of changes from the current situation by looking ahead and taking an objective and abstract approach to identify alternatives, make choices, implement the plan, and revise accordingly. Similarly, Gioia and Isquith (2004) indicated that planning refers to the identification and organization of steps and elements needed to accomplish intentions or goals. Pennington and Ozonoff found that planning is a consistent area of weakness in individuals with ASDs.

Prior and Hoffman (1990) compared the planning skills of children with ASDs to a group of children with learning disabilities. The two groups were matched for age and IQ and asked to complete Milner Mazes, a neuropsychological task that taps important aspects of cognitive and spatial function, including frontal lobe impairment (Milner, 1964). Prior and Hoffman concluded that individuals with autism exhibit planning deficits for simple motor tasks when compared to same age peers with learning disabilities. This study, designed to examine differences in performance, also found that new tasks with poorly defined rules requiring a higher degree of interplay, inhibitory processes, parallel computational strategies, and simultaneous considerations of more than one solution may be particularly challenging for individuals with autism (Hughes, Russell, & Robbins, 1994).

To determine the differences between groups of children with autism and neuro-typical children, Hughes, Russell, and Robbins (1994) and Ozonoff, Pennington, and Rogers (1991) designed a study with the Tower of Hanoi (TOH)/London Task, an EF task that taps cognitive skills mediated by the frontal cortex, such as working memory and inhibition processes (Simon, 1975). Both studies found that the group of children and adolescents with autism exhibited deficits in planning when compared to the neuro-typical group. The authors concluded that the individuals with autism were unable to learn from their mistakes, presented more repetitive incorrect strategies, and did not generate strategies to overcome their difficulties with the task at hand.

Ozonoff and Jensen (1999) compared children with autism, Tourette Syndrome (TS), and Attention Deficit Hyperactivity Disorder (ADHD) on three different components, also referred to as domains of executive functions: flexibility, planning abilities, and inhibition. The authors administered three tests: (a) Wisconsin Card Sorting Test, a measure of EF to assess the ability to form abstract concepts, shift and maintain set, and utilize feedback (Grant & Berg, 1948), (b) Tower of Hanoi/London task (TOL; Simon, 1975), and (c) Stroop Color-Word Test, a neuropsychological measure of cognitive flexibility and inhibition (Stroop, 1935) to 40 children with ASDs (aged 6-18 yrs), 30 children with TS (aged 8-17 yrs), 24 children with ADHD (aged 8-18 yrs), and 29 control typically-developing children (aged 8-17 yrs). The group with ASDs demonstrated definite difficulties on the tasks of flexibility and planning, while demonstrating average performance on the test of inhibition. Their deficits in these areas were found to be significant relative to, not only the controls, but also the TS and ADHD groups. The ADHD group demonstrated difficulty on the task thought to measure inhibition, and the TS group demonstrated no deficits relative to the controls. Ozonoff and Jensen suggested a distinctive pattern of executive functions in the three groups: ASDs, TS, and ADHD.

Gioia et al. (2002) examined executive function profiles using the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia, Isquith, Guy, & Kenworthy, 2000) based on parent ratings of children with inattentive and combined types of Attention-Deficit Hyperactivity Disorder (ADHD-Inattentive; ADHD-Combined), ASDs, moderate and severe Traumatic Brain Injury (TBI), and Reading Disabilities (RD). The parents' ratings were compared to ratings of neuro-typical participants. Profile analysis revealed significant differences in global elevations and in profiles of scale elevations between diagnostic groups. ASDs, ADHD-Inattentive and ADHD-Combined groups exhibited greater elevations on the BRIEF scales than did RD and severe TBI groups, who were in turn more elevated than moderate TBI and neurotypical groups. The group with ASDs was unique in its frequency and severity of planning deficits, which revealed elevated profiles when compared to the ADHD-Inattentive, ADHD-Combined, RD, and TBI groups.

More recently, Kenworthy, Black, Wallace, Ahluvalia, Wagner, and Sirian (2005) used the BRIEF to examine the executive functions (EF) of a sample group of 72 children with high-functioning autism (HFA). HFA was determined through the collection of parent ratings and performance on laboratory measures of EF. The authors used a discrepancy analysis to isolate executive functioning on tasks that carry multiple demands. In their discussion, Kenworthy, et al., noted that HFA and AD groups showed differences in their performance on measures of EF. Moreover, results indicated global EF deficits in the combined group of children with HFA and AD. Kenworthy, et al., supported previous findings that within the EF domain, specific deficits in planning and organization were most prominent in a sample of individuals with autism symptomatology. Researchers proposed that individuals with autism present a core deficit in planning ability (Gioia, et al., 2002; Kenworthy, et al., 2005; Pennington & Ozonoff, 1996).

Self-monitoring is another of the EF components by which "an individual acknowledges himself to be the source of self-determined changes in perceptual input, actions, and mental episodes" (Hill & Russell, 2002, p. 159). It also refers to the capacity for inhibition of important sensorimotor behaviors and the related capacity for delayed responding, which emerges as the groundwork for later, more developed EF (Pennington & Welsh, 1995). Delayed and interrelated steps in the stimulus-response chain are pivotal characteristics of EF that set the ground for what is known about prefrontal pathways in human beings (Pennington & Welsh). In a more recent view, Fonagy and Target (2002) described self-regulation as “a key mediator between genetic predisposition and early experiences, and adult functioning.” (p. 307). The authors added that self-regulation refers to the child’s ability to “control the reaction of stress; to the capacity to maintain focused attention; and to the capacity to interpret mental states in themselves and others” (p. 307).

Currently, deficits in self-monitoring in autism receive limited discrepant support. Studies have addressed various aspects: deficits in imitation, motor planning, and the production of visual efference copies of their actions in a visual code (Hughes, 1996; Russell, 1997). Additionally, Baron-Cohen, et al. (1996) suggested that when compared to children with mild learning disabilities, children with autism failed to monitor their intentions adequately and to encode the information for later recall.

Joseph, McGrath, and Tager-Flusberg (2005) examined executive dysfunction and its relation to language ability in verbal school-aged children with autism. This study compared 37 children with autism to 31 neuro-typical children, who were matched on age and verbal and nonverbal IQ, but not on language ability. The authors found that children with autism were less developed in their language skills than the comparison group. The correlation analyses revealed no association between language ability and executive functions in the autism group. In contrast, executive functions were positively correlated with language ability in the comparison group. Joseph and colleagues (2005) suggested that executive dysfunction in autism is not directly related to language impairment per se, but rather involves an executive failure to use language for self-monitoring purposes.

Russell and Hill (2001) reported that children with autism have the ability to perform age appropriately on executive functions tasks that require simultaneous inhibition of a dominant response and the performance of another action. The authors conducted three experiments, in which they examined whether an executive functions model can predict behavioral responses of children with ASDs. Russell and Hill reported that all three studies failed to support the claim that an EF model can predict self-monitoring deficits in children with ASDs. Specifically, Experiment 1 demonstrated intact abilities in the self-monitoring of basic actions (detecting the controlling stimuli). Experiment 2 demonstrated intact abilities in reporting an intention, both for self and for another agent, when the outcome was unintended but desired. Experiment 3 used the "transparent intentions task" (with a minor qualification) and demonstrated intact ability in reporting actions when the resulted action was unexpected.

Hill and Russell (2002) suggested that self-monitoring is a key component of executive functions; however, Hill and Russell also found that deficits of self-monitoring cannot be attributed to autism symptomatology. Hill and Russell investigated whether a self-monitoring deficit is present in individuals with autism by examining three groups of children: 20 children with autism, 20 children with moderate learning difficulties, and 20 neuro-typical children. All three groups participated in an action memory task. The tests consisted of two steps: (a) the participants and the investigator took turns to produce actions with pairs of objects; (b) the participants were presented with an unexpected recall task in which they were required to (i) make a familiarity judgment, (ii) produce an event memory, and (iii) produce a source attribution (self/other) concerning the actions performed on these pairs of objects.

Hill and Russell concluded that children with autism did not demonstrate difficulty in remembering that two objects had been paired together. The authors noticed significant differences in the range of accurate responses in children with autism when compared to those with moderate learning disabilities. Hill and Russell provided some evidence that children with autism can successfully initiate and complete action-monitoring tasks associated with judgments about themselves and others. The study emphasized that the results cannot disregard deficits in executive functions (other than self-monitoring) as a primary deficit in children with autism.

Inhibition is a component of executive functions that refers to the inability to resist, or to not to act impulsively, and the ability to stop one's own behavior at the appropriate time (Welsh & Pennington, 1988). Even though many authors have linked inhibitory behaviors to deficits of ADHD, individuals diagnosed with

ASDs also present characteristics compatible with an inhibitory deficit. In fact, some researchers argued that this component of executive functions is considered as a primary deficit when defining symptoms of autism (Russell, Jarrold, & Henry, 1996; Senn, Espy, & Kaufmann, 2004).

Ozonoff (1997) pointed out that the third set of symptoms in the ASDs triad, restrictive, repetitive, and stereotypic behaviors, are associated with deficits of inhibition. Ozonoff stated that due to the heterogeneous nature of symptoms of ASDs, many of the repetitive and restrictive behaviors associated with ASDs appear to be different according to the child's developmental and cognitive level. Additionally, Ozonoff found that individuals with autism and those with higher level functioning abilities have a tendency to exhibit more insistence on sameness than individuals with Asperger Disorder, who have an elevated level of restricted interests. On the other hand, individuals with lower developmental and cognitive abilities have been reported to exhibit more motor stereotypic behaviors, such as hand flapping and rocking.

Ciesielski and Harris (1997) studied inhibitory and switching processes, such as new tasks with poorly defined rules, in a group of individuals with autism. The study sample consisted of 19 HFA individuals with an IQ lower than 85 and 16 control individuals with an average psychometric intelligence. Both the control and HFA groups were matched for age (12-35 years) and socioeconomic status. Ciesielski and Harris showed that the level of performance of the HFA group was significantly lower than that of the control group in all executive tasks, and the performance was characterized by repetitive, "stuck-in" set errors. The error rates increased in tasks with a low degree of rule constraints for the participants with HFA, but not for the control group, and the level of performance on executive function tasks appeared to be generally independent of psychometric intelligence level. The authors reported that the performance failure with executive function tasks in individuals with autism may be primarily attributed to a deficit in selection of inhibitory resources, as was evidenced by the escalation of preservative behaviors for individuals with autism in tasks with a low degree of rule constraints.

Senn, Espy, and Kaufmann (2004) discussed the emergence of executive functions in early development and used statistical methods to understand the interrelations among executive processes. The authors compared the performance of 117 preschool children (ages 2 years, 8 months to 6 years) on several executive functions tasks. Path analysis was used to determine the relationship between complex problem solving, working memory, inhibition, and set-shifting processes. Senn and colleagues stated that the best-fitting model included paths from working memory and inhibition to problem solving. A correlation between working memory and inhibition was found. In addition, the researchers concluded that in younger children, inhibition was the strongest predictor of problem solving; whereas, working memory contributed more strongly in older children.

In a similar study, Lopez, Lincoln, Ozonoff, and Lai (2005) examined the relationship between cognitive processes and the restricted, repetitive symptoms of AD. This study compared 17 children with ASD and 7 neuro-typical individuals on an executive function battery (Delis-Kaplin Executive Function Scales; Delis, Kaplan, & Kramer, 2001). Restricted, repetitive symptoms were measured by a variety of instruments (e.g., the Autism Diagnostic Observation Schedule, Autism Diagnostic Interview-Revised, Gilliam Autism Rating Scale, and the Aberrant Behavior Checklist). Lopez et al. found that several executive processes (e.g., cognitive flexibility, working memory, and response inhibition) were highly related to the restrictive, repetitive symptoms of AD. Other executive processes (e.g., planning and fluency) were not found to be significantly correlated with restricted, repetitive symptoms. Interestingly, the authors supported that an executive function model consisting of relative strengths and deficits was the best predictor of restricted, repetitive symptoms of autism.

Bishop and Norbury (2005) compared the performance of four groups of children: high-functioning autism, pragmatic language impairment, specific language impairment, and neuro-typical. Inhibition ability was assessed using two sub-tests from the Test of Everyday Attention for Children, one requiring a verbal response and the other a non-verbal response. Even though Bishop and Norbury found evidence of inhibitory deficits, these were neither specific to autism nor linked to particular aspects of autistic symptomatology. Bishop and Norbury discussed that the inhibition deficits appeared to be associated with poor verbal skills and inattention. Although the authors concluded that impairment in executive functions has been described in autism, there has been debate as to whether response inhibition is specifically affected. Bishop and Norbury suggested that future studies need to have controls for structural language skills and attention deficit when evaluating neurocognitive deficits in autism. Reliance on control groups matched solely on vocabulary level or non-verbal mental age may obscure the important role played by language skills in executive functions.

Working memory refers to the ability to simultaneously process and store information (Baddeley, 2002) and is thought to be a main underlying component of executive functions (Roberts & Pennington, 1996). Working memory plays an essential role in cognitive activities such as learning, comprehending, and reasoning (Baddeley, 2002), and can also impact social interaction due to the need to integrate constantly changing context-specific information (Bennetto, et al., 1996). Initial research in working memory in autism was driven by studies of performance on Tower tasks (Tower of Hanoi, Tower of London), which is poor in individuals with autism. Tower tasks are thought to measure planning and organization, and should require working memory when maintaining a mental representation and cognitively processing a response or action is required.

While individuals with autism generally demonstrate intact memory on simpler memory tasks, deficits are often noticed on tasks that require working memory in combination with other executive function abilities. Specifically, deficits have been found in individuals with autism on tasks involving planning, organizing, and self-monitoring (Bennetto et al., 1996). If individuals with autism are found to present deficits in working memory, then any difficulties found in self-monitoring abilities could be a function of deficits in working memory. However, a study completed by Farrant, Blades, and Boucher (1998) found that individuals with high functioning autism failed to perform on a monitoring task. Farrant et al. presented a list of words followed by a voice on an audiotape. After each presentation, either the child or the investigator was asked to repeat the word. Reality monitoring on this task required that, in a subsequent memory task, participants correctly identify whether self or the investigator had said the word.

Currently, investigations have found mixed evidence of deficits in self-monitoring associated with poor working memory in autism. One possible explanation for the mixed results is that independent investigations have examined different aspects of monitoring and working memory. While some studies carefully controlled for cognitive abilities, such as language development, other studies did not control for such variables, making it difficult to establish comparisons across studies.

Russell, Jarrold, and Henry (1996) demonstrated that children with autism are specifically impaired on tests of working memory. The authors investigated two aspects of working memory impairment in children with ASDs. The first investigation showed that children with autism were at least as likely as typical children to use articulatory rehearsal and that they had superior memory spans to that of children with moderate learning difficulties. In the second investigation, participants were given "capacity tasks" in order to examine group differences in the capacity of the executive functions of working memory. Russell, Jarrold, and Henry found that the performance of the children with autism was inferior to that of the neuro-typical group and similar to that of the children with moderate learning difficulties.

A number of researchers examined the development of working memory as it relates to children's understanding of false beliefs and administered tasks that imposed memory demands. Espy, Kaufman, McDiarmid, and Glisky (1999) investigated 117 preschool children (aged 22-66 months) and their performance on the A-not-B (AB) task with the purpose of establishing a relationship between executive function and frontal lobe maturity. Performance on the AB task required inhibition of only one previous response (A) and did not require shifting continuously from one set to another. Espy and colleagues (1999) suggested that the children's age significantly predicted their performance on the AB, Delayed Alternation, Spatial Reversal, Color Reversal, and Self-Control tasks. This study provided evidence that the AB task is sensitive to individual differences in age-related performance in preschool children and suggested that AB performance is related to both working memory and inhibition processes in children between 22-66 months of age.

Baron-Cohen, et al., (1996) described Theory of Mind (ToM) as an individual's "ability to infer the full range of mental states, such as beliefs, intentions and emotions, which cause an action" (p. 160). Bennetto, et al., (1996) and Russell, Jarrold, and Henry (1996) suggested that individuals within the autism spectrum exhibited deficits in Theory of Mind (ToM) and in combination with other EF domains. Carlson, Moses, and Breton (2002) concluded that the relationship between EF and ToM may involve specific processes of inhibition and/or working memory capacity contributing to ToM, or may be a reflection of general intellectual ability. In order to differentiate these alternatives, Carlson and colleagues administered task batteries measuring inhibitory control (IC), working memory, and ToM, as well as verbal and performance intelligence, to 47 neuro-typical preschool children. Carlson and colleagues found that inhibitory control tasks in which a dominant response needed to be suppressed, while a subdominant response was activated (Conflict IC), significantly predicted performance on false belief tasks over and above working memory and the intelligence measures, a simple delay task (Delay IC), and age. In contrast, working memory, Delay IC, and intelligence were not significant in this analysis. Conflict IC, but not Delay IC, was related to working memory. In summary, Carlson and colleagues suggested that the combination of inhibition and working memory (as reflected in Conflict IC tasks) may be central to the relationship between EF and false belief understanding.

Hala, Rasmussen, and Henderson (2005), examined three types of source monitoring ability (i.e., reality condition, external condition, internal condition) in children with autism and neuro-typical children. In three different conditions, participants were presented with word lists after which they were required to recall the source of the word for reality, and external and internal source-monitoring tasks. The authors confirmed the presence of group differences across all three conditions, with the comparison group outperforming the children with autism. The pattern of performance across the three conditions, however, was comparable for the two groups. Specifically, performance was higher on the reality monitoring task than either the external or internal source tasks for the children with autism. These findings were consistent with an executive functions account of the deficits in autism (Bennetto et al., 1996; Hill & Russell, 2002; Pennington & Ozonoff, 1996).

A recent study illustrated the correlation of autism and comorbid disorders, such as ADHD. Sinzig, Morsch, Bruning, Schmidt, and Lehmkuhl (2008) completed an investigation that aimed to evaluate and compare executive functioning (EF) profiles in children with ADHD and children with ASDs with and without a comorbid diagnosis of ADHD. Sinzig and colleagues sampled 4 groups of 20 children aged 6-18 years old in the following categories: (a) with ADHD; (b) with ASDs (High-Functioning Autism or Asperger Disorder); (c) without comorbid ADHD; and (d) a neuro-typical group. These groups were compared using a battery of EF tasks including inhibition, flexibility, working memory, and planning. Sinzig et al. found that participants with ASDs showed deficits in planning and flexibility abilities. Specifically, the ASDs with ADHD group exhibited more problems with inhibitory performance, but not in their working memory performance. In addition, the ASDs group was similar to the

ADHD group with regard to inhibitory performance, but not to working memory deficits. Moreover, Sinzig and colleagues noted that the evidence should be viewed cautiously given the heterogeneous nature of ADHD and ASDs.

Nonetheless, a neuropsychological model to understanding these conditions may prove useful for evaluating strengths and weaknesses in individual children. While the majority of research indicates that individuals with autism disorder present with working memory deficits, some studies have also shown that individuals with autism have intact working memory abilities. Bennetto, Pennington, and Rogers (1996) studied children with autism, who exhibited similar performance to a neuro-typical group on short and long-term recognition, cued recall, and new learning ability. Bennetto and colleagues revealed that individuals with autism demonstrated delays on temporal order memory, free recall, working memory, and executive functions when compared to the neuro-typical group. Ozonoff and Strayer (2001) examined working memory in a group of individuals with high-functioning autism, a group diagnosed with Tourette syndrome, and a neuro-typical group. Ozonoff and Strayer did not find group differences across three tasks and five dependent measures of working memory. The performance of the individuals with autism was significantly correlated with both age and IQ. Ozonoff and Strayer concluded that working memory is not one of the executive functions that appear to be impaired in individuals with autism. In more recent research, Williams, Goldstein, Carpenter, and Minshew (2005) studied verbal and spatial working memory in high-functioning children, adolescents, and adults with autism. Williams and colleagues found that individuals with autism performed within the average range on tasks of verbal working memory when using standardized measures. However, Williams and colleagues found increased deficits in spatial working memory, which might negatively impact information processing demands.

Williams, Goldstein, and Minshew (2006) administered a memory test to 38 high-functioning children with autism and 38 individually matched neuro-typical children, 8-16 years of age. Williams and colleagues found a profile of memory abilities in children with autism, which was characterized by poor visual and spatial working memory for complex stimuli with average associative learning ability, verbal working memory, and recognition memory skills. The authors explained that children with autism require less information from complex stimuli including complex scenes, sentences, and stories. Furthermore, Williams, Goldstein, and Minshew argued that it is possible that memory functioning deficits prevent children with autism from acquiring relevant information needed to negotiate their environment. In addition, these memory functioning deficits may hamper their ability to organize large amounts of information that is presented to them.

Emotional regulation refers to the ability to respond to continuously changing conditions of the social world, which involves the ability to evaluate and modify one's behavior and responses in light of relevant information (Loveland, 1991). Executive functions have been commonly associated with prefrontal cortex functions; however, it seems that regulation of social behavior, emotional reactions, and social discourse require EF as well (Dennis, 1991). Bennetto et al. (1996) and Ozonoff et al. (2004) postulated that deficits in executive functions contribute to social difficulties in individuals with ASDs. Bennetto et al. explained that individuals with autism seem to exhibit more social skill difficulties since effective social interactions depend on the ability to discriminate among stimuli, categorize stimuli according to previously learned concepts, inhibit responses, establish and sustain attention to stimuli, and use verbal feedback to change a desired behavior.

Baron-Cohen, et al., (1996) and Loveland (1991) supported previous findings on reduced empathy in individuals with autism, and they attributed social skill difficulties to a lack of awareness of another person's mental status. However, the difficulties may also be explained by an inability to determine the proper response to another's mental states. Moreover, Baron-Cohen (1996) suggested that individuals with autism typically deal with social-emotional situations by applying explicit rules or cognitive strategies learned from past experiences, rather than by identifying and responding to the unique nature of each situation in a flexible way. Thus, there is a need to understand the social-behavioral patterns by which individuals with ASDs use their limited information regarding social interactions to regulate their own responses, both behavioral and emotional.

The relationship between executive functions and emotional regulation has been examined as an important aspect of understanding cognitive development during early childhood (Blair, Zelazo, & Greenberg, 2005). Erickson, Drevets, and Schulkin (2003) proposed a model that focuses on the relationship between the influence of pre-frontal, limbic, and brainstem structures and constructs of executive functions, such as emotional and autonomic responses to environmental stimuli. Erickson and colleagues suggested that the relationship between emotional responses and the prefrontal, limbic, and brainstem structures is highly consistent with the premise that EF are goal directed. Erickson and colleagues supported the view that cognitive processes, such as working memory, shifting, and inhibitory control, are essential to achieve a goal-oriented task, such as problem solving and regulation of behavior. However, at high levels of emotional arousal, these executive functions are likely to be repressed (Blair, Zelazo, & Greenberg, 2005). Griffith, et al., (1999) indicated that individuals with autism present heightened challenges in their need to adapt and respond to demands involving the emotional regulation of their behavior.

In summary, emotional regulation deficits potentially affect the individual’s ability to maintain attention, to inhibit responses and establish and maintain peer relationships (Griffith, et al., 1999). Also, a number of researchers consistently showed that individuals with autism displayed deficits in emotional regulation across a range of environmental demands. They acknowledged emotional regulation challenges as a primary deficit of executive functions in individuals with autism (Griffith, et al., 1999; Ozonoff, Pennington, & Rogers, 1991).

One of the first studies to document a relationship between emotional perception and autism was conducted by Ozonoff, Pennington, and Rogers (1991). Ozonoff and colleagues showed evidence of executive function deficits in individuals with autism and their relationship to emotional perception tasks. The authors compared two groups: individuals with HFA (n=23) and a control group between the ages of 8-20 years (n=20). Both groups were matched for age, IQ, sex, and socio-economic status. Ozonoff and colleagues found group differences on executive functions, theory of mind, emotional perception, and verbal memory tests, but no differences on spatial memory tests. The authors concluded that executive function deficits were widespread among the group of individuals with autism.

The relationship between executive functions and social interaction in preschool-aged children with autism was examined by McEvoy, Rogers, and Pennington (1993). The researchers found that the children in the group with ASDs exhibited a significantly larger number of repetitive behaviors on a test of executive functions when compared to a neuro-typical group. Also, McEvoy and colleagues reported that children with ASDs exhibited significantly fewer joint attention and social interaction behaviors than the neuro-typical group.

Griffith, Pennington, Wehner, and Rogers (1999) examined executive functions of preschool-aged children with ASDs. Griffith and colleagues compared the performance of preschoolers with autism (mean age of 4.3 years) to a control group matched by age, verbal, and nonverbal abilities. Griffith, et al., reported that preschool children with autism initiated fewer joint attention and social behaviors when compared to a control sample, based on their performance on eight executive function tasks (A not B, Object Retrieval, A not B with Invisible Displacement, 3-Boxes Stationary and Scrambled, 6-Boxes Stationary and Scrambled, and Spatial Reversal). These findings are consistent with previous studies (McEvoy, et al., 1993; Ozonoff, et al., 1991) in that they demonstrated that individuals with autism have difficulties with social-emotional behaviors that require the use of executive functions, further adding to the validity of the deficit.

Over the past two decades, the role of executive function deficits in individuals with autism has been well documented. The hallmarks of the executive functions profile in individuals with autism are deficits in planning and organization (Kenworthy, et al., 2005; Pennington & Ozonoff, 1996), self-monitoring (Bennetto, et al., 1996; Joseph et al., 2005), inhibition (Ciesielski & Harris, 1997; Senn, et al., 2004), working memory (Farrant, et al., 1998; Russell, Jarrold, & Henry, 1996), and emotional regulation (Espy, et al., 1999; Gioia & Isquith, 2004; McEvoy, et al., 1993; Ozonoff, et al., 1991). The research consistently shows a strong correlation between executive function deficits and the core defining symptoms of ASDs. Executive functions are complex systemic processes that undergo a long developmental process (Blair, Zelazo, & Charney, 2001; Denckla, 1996; Gioia & Isquith, 2004; Pennington & Ozonoff, 1996) and have profound consequences for overall cognitive and emotional development, which are areas unevenly developed in individuals with ASDs.

Components of Executive Functions and Preschoolers with ASDs

Theory of Mind (ToM) involves the ability to establish differences between the real world and mental representations of the real world. Osterling and Dawson (1994) studied ToM during early childhood stages as seen in children with autism. Other investigations revealed that older children with autism exhibit deficits in ToM, the ability to attribute mental states (i.e., beliefs, desires, emotions, perceptions, and intents) to self and others in order to predict behavior (Baron-Cohen, et al., 2000). Dawson and Osterling (1994) investigated emerging stages of ToM in order to identify early markers of autism in young infants via videos during their first birthdays. The authors coded home videotapes of 11 children with autism and 11 neuro-typical children's first-year birthday parties for social, affective, joint attention, communicative behaviors, and specific autism symptoms. Osterling and Dawson concluded the children with autism displayed significantly fewer social and joint attention behaviors and significantly more ritualistic symptoms, such as repetitive movements.

Later, in a clinical study of 22 children, Moore and Goodson (2003) found that a diagnosis of ASDs at age two was reliable and stable. Of the 22 children, who had been identified as presenting early markers of autism under age 2 years, 20 children received the same diagnosis when reassessed at ages 4-5 years. The findings are similar to those of other studies; however, Moore and Goodson found that children, whose scores deteriorated in the social domain, tended to have presented initially with more significant behavior problems. Few repetitive behaviors were observed at age 2 years; whereas, these behaviors were more apparent by ages 4-5 years. The importance of the findings that early diagnosis of autism is reliable at age 2 has led to the development of EI programs. These programs may prevent many other social-emotional and behavior problems from occurring later in the child's life. Baron-Cohen, et al., (2000) supported that ToM can explain social and communication deficits in children with ASDs.

In an attempt to examine the ability of young children diagnosed with ASDs to visually orient to naturally occurring social situations, Dawson, Meltzoff, Osterling, Rinaldi, and Brown (1998) compared children with autism to children with Down syndrome and children who were developing typically. The study found that compared to children with Down syndrome or typical development, children with autism more frequently failed to orient to all stimuli and this failure was much more extreme for social stimuli. Children with autism, who oriented to social stimuli, took longer to do so; when compared with the other two groups of children, and children with autism also exhibited impairments in shared attention. The authors agreed with Osterling and Dawson's conclusion (1994) that these social attention deficits may have contributed to difficulties in social and joint attention found in autism.

The complexity and range of neurocognitive skills and deficits presented in children with ASDs, combined with the nature and limitations of traditionally used methods of assessment of EF for preschool children, make understanding this group with ASDs specially challenging (Klin, Chawarska, Rubin, & Volkmar, et al., 1994). Despite this difficulty, Kanner (1943) stated that delays presented in children with autism are observable across developmental stages. Also, Hill (2004) established that even though EF are considered complex neurocognitive skills, it is pivotal to acknowledge their hierarchical development from early childhood to late adolescence.

Attention difficulties in children with ASDs are well researched (Klin, et al., 2004; Osterling, et al., 2002; Volkmar, Chawarska, & Klin, 2005). Both the level and degree of difficulties presented in children with ASDs depend upon the child's ability to establish and sustain attention, maintain joint attention, and filter attention in settings with multiple stimuli, in particular auditory stimuli (Osterling, et al.). Preschool children with autism might encounter more difficulties in establishing and sustaining their attention with people than with objects (Dawson, et al., 1998), as evidenced in part by their tendency to look at and play with objects rather than with people. Klin, et al., (2004) found that delays in the development of social attention are evidenced by the child's marked inabilities to attend to people's faces, as compared to neuro-typical peers. In an attempt to provide an explanation for such early differences, Klin, et al., suggested that children with autism tend to avoid complex visual stimuli (e.g., faces) or unpredictable and variable social stimuli.

One of the most predominant markers for individuals with autism is social difficulties (Volkmar, et al., 1994). Typically, preschool children with autism fail to demonstrate social skills present during the first months of life (Klin, et al., 2004). Eye contact is limited, as is overall social engagement and responsivity. Klin, et al., (2004) found marked delays in the area of joint attention; such behaviors are essential in the development of communicative and social-cognitive abilities. Throughout the child's lifetime, imitation and response for joint attention improve in children with autism (Klin, et al., 2004), but they continue to be impacted in natural settings.

An early study examining social patterns of children with ASDs (McEvoy, Rogers, & Pennington, 1993) compared a group of preschool children with autism to a typically developing matched control group. The study revealed that children with autism communicated with their peers for different reasons and employed different nonverbal behaviors to communicate. The authors found that children with autism seemed to have similar rates of communication to request objects or actions; however, children with autism communicated less to establish joint attention or demonstrate interest toward another person.

Other studies within the same framework explored the developmental aspects of imitation and play and concluded they are rarely essential for adequate development of social-cognitive skills. Rogers, Ozonoff, and Maslin-Cole (1993) compared the attachment behaviors of 32 young children with autism by examining variables such as chronological age, mental age, language level, and social level. The authors found that 50% of the children demonstrated some behaviors indicative of secure attachment (no children were unattached), and the children's developmental level, not severity of autism, was the strongest predictor of attachment security. Rogers and colleagues suggested that autism does not preclude the development of secure attachment relationships in young children, but rather it delays the development of secure attachment and may alter the behavioral patterns that express attachment security. Similarly, Loveland (1991) and Osterling et al. (2002) found that delays in social attention and play skills may be present at least by the child's second birthday. Moreover, the authors explained that atypically developing infants do not differ from typically developing ones in their play activities during their first months of life. However, by the child's first year, these delays are noticeable and progressively delayed. By the end of their second year, typically developing children have matured in their attachment and are willing to explore their environments by engaging in parallel play with other peers (Osterling & Dawson, 1994). On the other hand, children with autism have developed an attachment to their parents and respond differently to familiar and unfamiliar persons. The quality of their attachments and ability to relate to others is quite different from their same-age typically developing peers (Volkmar et al., 1994).

The above-cited studies have also informed research in context-specific domains, such as social skills, affect and motivation, and executive functions in children with ASDs (Pennington & Ozonoff, 1996). An individual's ability to self-monitor and self-regulate complex behavior as part of maintaining overall goal-oriented behavior is linked to the individual's ability to adapt, adjust, and respond to a particular situation in an appropriate and efficient manner (Griffith, et al., 1999; Pennington & Ozonoff, 1996). Since EF regulates complex behaviors, researchers (Isquith, et al., 2005) suggested that an individual's ability to complete executive function tasks is directly related to complex behavioral responses including cognitive, emotional, and social responses.

Every day the life of a young child brings various opportunities in which to explore, imitate, and respond to environmental demands. Denckla (1996) researched children's early responses to their familiar environment and stated that these responses are pivotal for the future development of executive functions. In the case of preschool children with complex neurocognitive delays, self-control and emotional regulation skills needed to respond to the environment are not well established nor developed (Isquith, et al., 2005). This suggests an adverse impact on their cognitive, adaptive, emotional, and social development. The existing literature on EF development suggests a correlation between neurocognitive behaviors and social environment. For example, in Dennis' (1991) description of EF development, preschool children with ASDs may face more challenges in negotiating their academic and social environment due to delayed development and acquisition of early EF, when compared with their typical peers.

There are a limited number of studies examining the profiles of EF in preschool children with ASDs (Denckla, 1996; Griffith, et al., 1999; Isquith, et al., 2005; & Klin, et al., 1996). Denckla (1996) and Isquith, et al., (2005) advocated the need for careful coordination of developmentally-based techniques capturing emergent features of executive functions of preschool children.

As described earlier, preschool children diagnosed with autism disorder often exhibit a complex and a wide range of symptoms which impact the child's unique pattern of neuropsychological strengths and weaknesses. Research on EF in children with ASDs also revealed that the range and complexity of symptoms are influenced by typical growth development, thus determining the child's unique pattern of learning, based on a neuropsychological model. These findings may shed light on effective EI practices for young children with ASDs (Filipek, et al., 1999; Hoyson, Jamieson & Strain, 1984; Joseph, 1999; Klin, et al., 1996; Lord, 1995; Pennington & Ozonoff, 1996; Stone, 1997). Moreover, it has become essential that school professionals increase their awareness and accurately identify the unique patterns of strength and weaknesses in young children with autism, thereby facilitating the children's paths toward functional lives (Filipek, et al., 1999; Sparrow, et al., 1997; Volkmar, et al., 1994).

Assessment of Executive Functions during Early Childhood

During the past decade, an increasing interest in the relationship of the model of executive functions (EF) in young children became evident. The EF model has been associated with brain-based behavior involving prefrontal cortex systems and related cognitive and emotional responses. Such responses are essential to the emerging EF processes of adopting, maintaining, and shifting cognitive sets, monitoring one's performance and self-correcting behavioral responses, inhibiting impulses, and regulating social-emotional responses (Blair, Zelazo, Charney, 2001; Gioia & Isquith, 2004; Pennington & Ozonoff, 1996).

Interest in the early development of EF increased due to the amount of supportive research devoted to the emergence and further development of EF during childhood. Even though mental health professionals must rely on behaviorally or diagnostically-based criteria currently in place, during the last two decades ASDs received an increased amount of attention as complex neuropsychological disorders (Joseph, 1999; Lord, 1997). A pediatric, neuropsychological model to explore the complexity of ASDs has been supported by researchers (Denckla, 1996; Joseph, 1999; Lord, 1997) as a possible comprehensive model for establishing a child's neurocognitive profile of strengths and weaknesses. A systematic categorization of neuropsychological functions in preschool children with ASDs may provide a theoretical framework to understand the behavioral and neuropsychological dimensions of the disorder.

It might also shed light on the planning, coordination, and implementation of tailored research-based mental health and educational interventions.

Despite the improvements of current practices in pediatric neuropsychological assessment, Gioia and Isquith (2004) reported marked discrepancies between results obtained from a neuropsychological instrument and the spectrum of symptoms reported by parents, caregivers, and school staff of children with developmental disabilities. Current pediatric neuropsychological tools have been used to identify EF deficits in preschool children with developmental disabilities, such as ASDs. These tools are NEPSY: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007) and the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P; Gioia, Espy, & Isquith, 2003).

Measures of Executive Functions in Young Children

Performance-based measure. The NEPSY: Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007) is an individually administered performance-based measure stemming from Luria's model of neuropsychological assessment of individuals with brain damage (Ahmad & Warriner, 2001). The NEPSY-II is a highly sensitive tool, which provides an in-depth understanding of the nature of the child's neurocognitive strengths and deficits, specifically those deficits related to frontal and prefrontal lobe functioning (Korkman, Kirk, & Kemp, 2001). Such deficits result in impairments of self-regulatory abilities, which include specific domains of language, attention, sensory input, and motor input (Denckla, 1994; Welsh & Pennington, 1988). Given the role of the frontal lobe in neuropsychological functioning, deficits in various domains of executive functions are defining characteristics of many developmental disorders (Gioia, et al., 2002; Isquith, et al., 2005; Pennington & Ozonoff, 1996). As Kemp, Kirk, and Korkman (2001) explained, the NEPSY-II follows the main core objectives of the 1998 NEPSY: to provide an instrument for the detection of deficits that interfere with learning, within and across the functional domains (i.e., attention/executive function, language, visual-spatial processing, sensorimotor, and memory and learning) for children from ages 5 to 12 years; to provide a tool for identifying and assessing brain damage and dysfunction and the extent to which they affect the development and operations within a functional domain; to provide a tool for long term follow-up in order to identify and clarify the developmental dynamics of specific types of brain damage or dysfunction; and to provide a developmentally-oriented tool that had been standardized on a single sample of children, which would result in a reliable and valid instrument to discriminate one's pattern of learning. Both the 1998 NEPSY and the NEPSY-II were developed as "flexible and comprehensive instruments, characterized by their developmental model to pediatric neuropsychological assessment and unique qualities of identification and remediation of specific cognitive skills" (NEPSY-II Clinical Manual, 2007, p. 5).

The assessment of impaired performance within and across functional domains of executive functioning, visual-spatial processing, and social perception is considered to be a key component of the NEPSY-II (Korkman, Kirk, & Kemp, 2007). The NEPSY-II consists of 32 subtests, which are divided into six content domains: Attention and Executive Functioning (Att/EF), Language, Memory and Learning (ML), Social Perception (SP), Sensorimotor, and Visual-spatial Processing.

The Att/EF domain consists of the following subtests: (a) Animal Sorting; (b) Auditory Attention and Response Set; (c) Clocks; (d) Design Fluency; (e) Inhibition; and (f) Statue. The subtests of Att/EF are designed to assess the inhibition of learned and automatic responses, monitoring and self-regulation, vigilance, selective and sustained attention, the capacity to establish, maintain and change a response set, nonverbal problem solving, planning and organizing a complex response, and figural response.

The ML domain consists of the following subtests: (a) List Memory; (b) Memory for Designs; (c) Memory for Faces; (d) Memory for Names; (e) Narrative Memory; (f) Sentence Repetition; and (g) Word List Interference. The subtests of ML assess immediate memory for sentences, narrative memory under free recall, cued recall, recognition conditions, repetition and recall of words presented with interference, and immediate and delayed memory for abstract designs, faces, names, and lists.

The SP domain includes the following subtests: (a) Affect and Recognition and (b) Theory of Mind. The subtests of SP measure facial affect recognition and the ability to comprehend others' perspectives, intentions, and beliefs.

As part of the standardization studies for the NEPSY-II, Korkman, Kirk, and Kemp (2007) sampled children ages 3 to 16 with a DSM-IV-TR clinical diagnosis of AD (n=23) and Asperger Disorder (n=19). The inclusion criteria for this study were as follows: (a) absence of a neurological dysfunction not typically associated with autism; (b) IQ greater than or equal to 80 for the autism group, and 85 for the Asperger group; (c) absence of a specific learning disability; (d) no concurrent psychiatric diagnoses; (e) and normal or corrected visual and auditory acuity. The sampled group could carry a co-diagnosis of ODD and/or ADHD. Both Autism and Asperger groups were randomly matched to a control group for the following variables: (a) age; (b) sex; (c) race; (d) and parent education level as part of the normative sample for comparison of neurocognitive performance.

Korkman, Kirk, and Kemp (2007) found that children with autism exhibited compromised areas of development across all domains assessed in comparison to the control group. Specifically, within the Att/EF domain, measures of sorting, cognitive flexibility, and auditory attention were impaired; whereas, impulse control was within the average range. The group of children with autism showed deficits in areas pertaining to memory and language functioning, although to a lesser degree than observed for executive functions.

Korkman and colleagues reported that the group of children with autism demonstrated more difficulties within the SP domain, when compared to the control group. The authors explained that nearly 70% of children with autism obtained lower scores in Theory of Mind (ToM), as compared with 10% of the control group. The NEPSY-II standardization studies revealed a global impact on EF in children with ASDs. Korkman and colleagues suggested that primary deficits in executive functioning (i.e., language and memory) have a ripple effect in other cognitive domains (e.g., auditory attention, cognitive flexibility).

Korkman, Kirk, and Kemp reported that the group of children with Asperger Disorder demonstrated impaired skills within the Att/EF domain, specifically on measures of attention and speed when responding verbally; however, measures of nonverbal sorting and planning were performed within the average range. As reported, the sample of children with Asperger Disorder showed deficits in facial and visual memory functioning, but the Asperger group performed within the average range on the Language and Affect Recognition domains. Korkman, Kirk, and Kemp also reported that the Asperger group obtained lower scores on the ToM subtest when compared to the control group. Overall, the authors highlighted that children with Asperger Disorder demonstrate impairments in visual memory (i.e., facial memory), attention, fine-motor abilities; speed related or timed tasks, and visual-constructive abilities. On the other hand, the Asperger group demonstrated relatively intact performance on language and verbal memory skills, as well as better developed Affect Recognition and Theory of Mind than the group of children with autism.

There is limited research literature pertaining to the validity and reliability of the 1998 NEPSY investigating the learning patterns of children with developmental disabilities, particularly ASDs. One of the initial researchers to investigate the impact of developmental disorders on neuropsychological abilities used the Finnish version of the NEPSY. Korkman and Peltomaa (1991) studied 46 children with mild developmental disorders, with the purpose of identifying different neuropsychological profiles that would predict attention problems at school. Korkman and Peltomaa found that the test profiles of the subgroups were suggestive of attention deficits, based on deficits in areas of impulse control, sustained attention, and selective attention. The authors found that the "at-risk" group continued to exhibit attention difficulties, when compared to their peers. Korkman and Peltomaa reported that the Finnish version of the NEPSY may be a useful tool for examining cognitive abilities and neuropsychological functioning in young children at-risk for learning difficulties at school.

Later, Korkman, Kemp, and Kirk (2001) studied the effects of age across the age range 5-12 years on the standardization of the NEPSY-A Developmental Neuropsychological Assessment (1998). The authors sampled 800 children from the United States on 20 subtests of the NEPSY. Korkman and colleagues used a one-way ANOVA to analyze the subtest raw scores derived from measures of attention and executive functioning, language, sensorimotor functions, visual-spatial functions, and memory and learning. Korkman, Kemp, and Kirk indicated that age effects were very significant across all measured domains, which characterized the NEPSY as a developmentally sensitive measure of neurocognitive abilities. Neurocognitive abilities were found to become more evident within the 5 -8 year age range and demonstrated a rapid rate of growth within the 9-12 year age range. Other studies supported Korkman and colleagues' statement of evident and rapid neurocognitive development during the early childhood years (Isquith, et al., 2005), which led to increased understanding of different patterns of brain-based behavior.

Clearly, an increased body of research has been devoted to the study of profiles of EF in preschool children with ASDs (Denckla, 1996; Griffith, et al., 1999; Kiln, et al., 1996; & Isquith, et al., 2005). These authors have highlighted the importance of these profiles and their recommendations in early detection of symptoms of developmental disorders, as well as the provision of more appropriate intervention services.

Nydén, Carlsson, Carlsson, and Gillberg (2004) studied 30 children ages 9 years, 5 months to 17 years, 5 months with ASDs to investigate their performance on the NEPSY in the areas of integration and transfer of information (i.e., visual, auditory, and motor). The researchers matched the sample for age, sex, and IQ (greater than 75). Nydén and colleagues stated that children with ASDs performed significantly lower than the control group on most of the NEPSY subtests. Nydén, Carlsson, Carlsson, and Gillberg supported the view that the performance of children with ASDs may be impacted by processing and transferring of information.

Schmitt and Wodrich (2004) examined the validity of 13 subtests of the NEPSY by comparing scores for 30 children with an average age of 9.3 years with neurological delays, 35 children with an average of 9.8 years considered at-risk of academic problems, and 39 neuro-typical children, with an average age of 9.8 years. The authors found differences among the groups with and without controlling for IQ. Schmitt and Wodrich provided supportive data for the validity of several NEPSY subtests in discriminating children with neurodevelopmental delays. Similarly, Joseph, McGrath, and Tager-Flusberg (2005) completed a study, which investigated language abilities of 37 children with ASDs, based on their performance on the NEPSY. Joseph and colleagues compared the performance of children with autism to the performance of 31 neuro-typical children. Schmitt and Wodrich used a matched sample (i.e., age, verbal, and nonverbal IQ). The authors concluded that children with autism exhibited deficits when compared with the control group across all three domains of executive functions, which included working memory, inhibitory control, and planning. In addition, Joseph and colleagues found that children with autism demonstrated less developed language skills; however, the authors did not find a correlation between language ability and executive functions performance in the group of children with autism. On the other hand, executive functions were positively correlated with language ability in the control group. These patterns suggested that executive dysfunction in autism is not directly related to language impairment; however, they imply an executive functions deficit when language is needed for self-regulatory behavior.

In an attempt to understand preschool-aged children, who presented early signs of hyperactivity and oppositional-defiance, Youngwirth, Harvey, Gates, Hashim , and Friedman-Weieneth (2007) compared the performance of children from age 4.0 to 6.5 years on attention/executive function, language, memory, and sensory-motor abilities as measured by the NEPSY. A total of 237 children were divided into four groups based on their parents' report of behavior using rating scales and a diagnostic interview. The four groups were (a) hyperactive only (HYP), (b) oppositional-defiant only (OD), (c) hyperactive and oppositional-defiant (HYP/OD), and (d) neuro-typical children. Youngwirth and colleagues reported the HYP/OD group scored significantly lower than the neuro-typical group on four of the nine subtests of the NEPSY including executive function, short-term verbal memory, and language comprehension subtests. Youngwirth and colleagues postulated that neuropsychological deficits can be observed among preschool children with hyperactivity, particularly when comorbid oppositional-defiance is present.

Teacher rating scale. The Behavior Rating Inventory of Executive Functions-Preschool (BRIEF-P; Gioia, Espy, & Isquith, 2003) is a standardized rating scale designed to assess the range of behavioral manifestations of executive functions of preschool children. The BRIEF-P describes executive functions in the everyday and natural context, providing an ecological perspective of the child's current executive functioning and development (Gioia, Espy, & Isquith, 2003). Isquith, Crawford, Espy, and Gioia (2005) explained that executive functions (i.e., working memory, flexibility, and inhibition) can be differentiated during preschool years of the child's development. Moreover, the developmental path of these executive functions varies from individual to individual (Espy, Kaufman, McDiarmid, & Glisky, 1999; Hughes, 1996) based on a number of factors such as age of skill onset, developmental rate, and the level of proficiency at any given age.

While the development of attentional control, future-oriented problem-solving, and self-regulation of emotions and behavior begin during early infancy (Diamond and Gilbert, 1989), other more complex and further matured skills (i.e., problem solving and planning) appear to be more apparent during later childhood years (Espy, Kaufman, McDiarmid, & Glisky, 1999). There is increasing evidence that different neurological and behavioral disorders in preschoolers are characterized by unique patterns of executive functions evidenced in school-aged children and adolescents (Diamond & Gilbert, 1989; Espy, Kaufman, McDiarmid & Glisky, 1999; Hughes, 1996; McEvoy, Rogers & Pennington, 1993).

Unfortunately, the developmental components of executive functions of preschool children with developmental delays have not been consistently documented (McEvoy et al., 1993). School professionals continue to struggle to assist preschool-aged children with disabilities (Kort, 2004). Everyday environmental demands present continuous challenges for children with ASDs, particularly the development of executive functions (i.e., keep a goal in mind, follow through a sequence of steps to attain a goal, inhibit responses to extraneous events, generate novel and creative responses to newly introduced information) (Rogers, 1998). Thus, being able to identify emerging EF profiles for these children is essential for development of intervention strategies, which emphasize consistency, routine, and predictability, in combination with a multi-sensory model for planning daily routines, preparing for unpredictable events, as well as facilitating a comprehensive and functional skills acquisition process.

Espy, Kaufman, Glisky, and McDiarmid (1999) highlighted the importance of assessment practices in which school professionals collect data in the child's natural setting(s). Moreover, Kort (2004) supported the vast amount of information parents and professionals share about the child's behavior in these natural settings as it adds to the understanding of the relationship between behavior and brain-based functions.

Traditionally, mental health practitioners integrated both methods of standardized instruments and direct-observation of the child's behavior to assess psychological and neuropsychological constructs. Practitioners also used rating scales based on well-established structured measures of overt behavior which assessed various domains of social, emotional, and behavioral functioning. One commonly used rating scale is the BRIEF-P, which was developed to assess executive functions of preschool children. Gioia and colleagues (2000) stated that rating scales successfully assess domains of social, emotional, and behavioral functioning, as in the case of the BRIEF-P. In addition, the BRIEF-P contains a number of interrelated constructs designed to assist with interventions and early educational planning for young children with disorders of executive function (Gioia, Espy & Isquith, 2003).

The BRIEF-P assesses five non-overlapping clinical scales, which measure different domains of executive functions: Inhibit, Shift, Emotional Control, Working Memory, and Plan/Organize (Gioia, Espy & Isquith, 2003). The clinical scales form three broader indexes of Inhibitory Self-Control (ISCI), Flexibility (FI), and Emergent Metacognitive (EMI), as well as an overall composite score, the Global Executive Composite (GEC; BRIEF-P). The BRIEF-P demonstrated itself to be a valid and reliable instrument in the clinical assessment and diagnosis of developmental and acquired childhood conditions (e.g., language disabilities, attentional disorders, developmental pervasive disorders, other psychiatric and medical conditions) (Gioia, et al., 2002; Isquith, Gioia, & Espy, 2004). A review of empirical research supports the clinical validity of the BRIEF-P (Espy, et al., 1999; Gioia, et al., 2002; Isquith, et al., 2004; Isquith, et al., 2005; Senn, Espy, & Kaufmann, 2004). However, to date only a handful of studies sampled children with ASD using the BRIEF-P (Isquith, Gioia, & Espy, 2004; Gilotty, et al., 2002; Mackinlay, Charman, & Karmiloff-Smith, 2006).

The BRIEF-P revealed that EF deficits are evidenced through everyday life activities and may be specific to the environment, particularly for preschool-aged children with developmental disabilities. Isquith, Gioia, and Espy (2004), explored whether differences in EF could be measured by comparing parents' and teachers' ratings on the BRIEF-P of a neuro-typical group of children and a group of children with developmental disabilities. Isquith, Gioia, and Espy found that children with disabilities exhibited more weaknesses in executive behavior than neuro-typical children across all EF domains examined. Isquith and colleagues found that teachers did not report concerns with behaviors measured by the Inhibit scale for children in the developmentally delayed group. In contrast, parents' ratings for the same sampled group were scored within the significant range for the inhibition scale. The authors attributed this discrepancy to a higher degree of structure in preschool classrooms, which may limit the expression of inhibitory behaviors in that setting.

One of the few studies, which examined the preschool-age population of children with ASDs (Mackinlay, Charman & Karmiloff-Smith, 2006), investigated EF delays in high functioning children with ASDs based on parents' ratings on the BRIEF. The authors found that the group with ASDs exhibited more difficulties with their executive control in their daily lives relative to age, sex, and IQ matched controls. Specifically, the results of the BRIEF profile demonstrated elevated scores in the ability to plan, perform multiple tasks, switch from multiple tasks, and inhibit rule-breaking behavior. Mackinlay and colleagues discussed that this profile appears to be consistent with the neurocognitive profile of EF in older individuals with ASDs.

A study by Liebermann and colleagues (2007) examined the effect of executive functions (EF) and social cognition on individual differences in emotion regulation (ER) in preschool children. The authors sampled 60 preschool aged children and administered a battery of EF tasks and Theory of Mind tasks. In addition, parents completed the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P). Liebermann and colleagues concluded that the performance on the theory of mind tasks, as well as parental ratings of executive function and a component of EF (i.e., inhibition) were significantly correlated with children's displays of positive behaviors during the executive regulation task.

Mahone and Hoffman (2007) reported preschool children with ADHD were rated significantly higher than controls ($p < .01$) on all of the BRIEF-P five primary scales (Inhibit, Shift, Emotional Control, Working Memory, Plan/Organize) and on four indices (Inhibitory Self Control, Flexibility, Emergent Metacognitive, Global Executive Composite). In addition, within the ADHD group, the BRIEF-P Index scores were significantly correlated with ratings on the Conners' Parent Rating Scale. Mahone and Hoffman also found that the BRIEF-P had low, non-significant correlations with performance-based measures of EF, and patterns of correlations were not significantly different from those between the BRIEF-P and non-EF measures (e.g., sensorimotor, receptive vocabulary). Mahone and Hoffman concluded that the BRIEF-P has been shown to be a sensitive instrument to identify symptoms of ADHD; however, the results did not support the use of this measure for identifying EF strengths and deficits in students with ADHD.

During the past decade, many professionals and researchers have documented valuable data to assist in the identification of distinctive sets of neurocognitive strengths and weaknesses in preschool-aged children with ASDs (Filipek, et al., 1999; Isquith, Gioia, & Espy, 2004; McEvoy, 1993; Ozonoff, et al., 1991; Reynolds & Kamphaus, 1992). Even though studies of preschool-aged children's EF skills continues to be limited (Denckla, 1996; Griffith, et al., 1999; Hill & Russell, 2002; Sparrow, et al., 1997), it was documented that such skills present in a developmental sequence that begins during the early childhood years and continues throughout the individual's lifespan. Today, school psychologists provide direct behavioral and cognitive consultation to school staff facing daily challenges with young children with autism to keep a goal in mind, to follow steps to reach a desired goal, to inhibit their responses to extraneous events, and to generate novel and creative responses to new materials and everyday problems (Rogers, 1998). Therefore, the identification of EF profiles for children with ASDs during the preschool years could improve services and programming for these students, as well as life-long outcomes.

School-based Interventions for Children with Autism

The primary legal document in special education is the IDEIA-2004, which regulates the provision of special services for children identified as presenting with autism, among other disabilities. It is important to clarify that a diagnosis of autism under the DSM IV-TR criteria does automatically qualify a child to receive the services stipulated by IDEIA-2004. According to IDEIA mandates [1999 (c) (1) (i)], the following are eligibility criteria:

Autism means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, is generally evident before age three, and that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotypical movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences. The term does not apply if a child's educational performance is adversely affected primarily because the child has an emotional disturbance. (34 C.F.R. § 300.7)

States have the right to regulate eligibility through state health care and education codes. In New Jersey, this eligibility classification is defined in an administrative special education code as follows:

> "Autistic means a pervasive developmental disability which significantly impacts verbal and nonverbal communication and social interaction that adversely affects a students' educational performance. Onset is generally evident before age three. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routine, unusual responses to sensory experiences and lack of responsiveness to others. The term does not apply if the students' adverse educational performance

> is due to emotional disturbance as defined in (c) 5 below. A child who manifests the characteristics of autism after age three may be classified as autistic if the criteria in this paragraph are met. Assessments by a certified speech-language specialist and by a physician trained in neurodevelopmental assessment are required. (Title 6A: 14-3.5 (c) (2)"

Even though both DSM IV-TR and IDEIA-2004 criteria have shown discrepancies related to the definition of autism, the most essential factor of an identification process is a complete comprehensive assessment of the individual's strengths and weaknesses. Such an assessment process is based on multiple sources of information in multiple settings given that no single method will be able to reliably identify individual patterns of learning. While the DSM IV-TR and IDEIA-2004 provide slightly different definitions of ASD, they both stress that the most commonly used diagnostic tool among the medical and research communities is a comprehensive clinical observation of behaviors. Currently, both federal and state codes and regulations determine eligibility of special services within special education and provide regulations to coordinate a child's educational program.

IDEIA-2004 makes it clear that when it comes to the coordination of the child's program of services, it is essential to develop a common language to express the child's needs and ensure consistency and effectiveness of intervention (Filipek et al., 1999). Parents, school professionals, and physicians should advocate for treatment plans that are based on researched interventions and tailor recommendations based on comprehensive assessment procedures. Educational programs for children with ASDs include supplementary programs and services such as speech-language therapy, occupational therapy, physical therapy, and counseling. Some children are offered an extended school year program, usually an eight-week summer program, in order to prevent significant regression or loss of previously acquired skills. Because each child comes into contact with a large number of professionals and a variety of programs and services, it is crucial to share information and coordinate screening services, intervention, and treatment procedures. Collaboration, coordination, and the establishment of a strong, caring community are especially important given the need for individualized treatment programs for children with ASDs.

Advocates of early identification (Filipek, Accardo, Baranek, Cook, Dawson, Gordon et al., 1999; Harris & Handleman, 2000; Lord, 1995) provided empirical data supporting development of tailored interventions for children with autism disorder. Authors provided empirical data supporting early identification of children with autism and intensive EI programs during the toddler and preschool years. These interventions markedly improve the outcome for most children with autism. A number of identification processes have been used such as parent interviews, developmental scales, and psychometric measures employed as a screening process to identify those young children at-risk for any type of atypical development, and then followed by an in-depth screening process to identify specific marker behaviors for autism tendencies. Research on interventions with children with ASDs done in the last three to five years has stressed the importance of tailored and intensive educational interventions to enhance the later acquisition of social, communication, and cognitive skills (Harris & Handleman, 2000).

CHAPTER III

METHODS

Introduction

The following section will describe the methods and procedures used to collect and analyze data derived from the research. Specifically, this section will introduce the study design, statistical analysis, and the sample population of preschool children with Autism Spectrum Disorders (ASDs). In addition, a detailed description of previous research studies of children with autism will provide support for the analysis of power and effect size.

Research Design

This study used a non-experimental, comparative research study design to examine profiles of executive functions (EF) in preschool children with autism. Table 1 summarizes this comparative study. This type of design is typically used when the groups under investigation have been formed and the condition had already occurred (Fraenkel & Wallen, p. 370-374). A number of neuropsychological studies have used comparative research designs similar to the one presented in this study (Schmitt & Wodrich, 2004; Hala, Rasmussen, & Henderson, 2005; Joseph, McGrath, & Tager-Flusberg, 2005; Lopez, Lincoln, Ozonoff, & Lai, 2005). Specifically, this study utilized both a performance-based and an ecological approach, as perceived by students' teachers, to measure the EF of preschool children and to establish whether a relationship exists. A growing body of research supports this model as an explanation for the variable performance of executive functions of preschool children with ASDs and its overall impact on the child's daily functioning (Griffith, et al., 1999; Lord, 1997; Ozonoff, Rogers, & Pennington, 1991; Pennington, et al., 1997). The NEPSY-II (Korkman, Kirk, & Kemp, 2007) and the BRIEF-P (Gioia, Espy, & Isquith, 2003) have been employed as measures to distinguish patterns of basic neuropsychological functions, specifically executive functioning in preschool-age children. However, there is still a need for research exploring the neuropsychological patterns of executive functions of preschool children with ASDs. Therefore, the aim of this study was to compare both empirically-based data and developmentally-based rating scales of executive function skills in preschool children with ASDs. See Figure 1 which illustrates a research path with the relationship among the variables of age, age of symptoms onset, enrollment in EI services, comorbid factors associated with ASDs, as well as instruments of executive functions of preschool children.

This study attempted to compare specific neurocognitive profiles of preschool-aged children with autism, based on their performance on Att/EF, ML, and SP subtests of the NEPSY: A Developmental Neuropsychological Assessment- 2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007) with chronological age and EI services to ascertain possible differences in profiles regarding Att/EF, ML, and SP domains. In addition, this study attempted to explore the relationship between the participants' performance on the NEPSY-II and scores on teacher ratings of executive functions, based on the Behavior

Rating Inventory of Executive Functioning-Preschool (BRIEF-P; Gioia, Espy, & Isquith, 2003).

Table 1

Comparative Design

Sample group	Ages	Instruments	Dependent variables	Independent variables
Preschool with ASD	3.0 - 4.11 years & 5.0 -5.11 years	NEPSY-II	Attention/Executive Functioning Profile; Memory and Learning Profile; Social Perception Profile	Age; Age of Symptoms Onset; Enrollment in EI Program; Comorbid Factors
		BRIEF-P	Imitation Self-Control Index; Flexibility Index; Emergent Metacognitive Index	

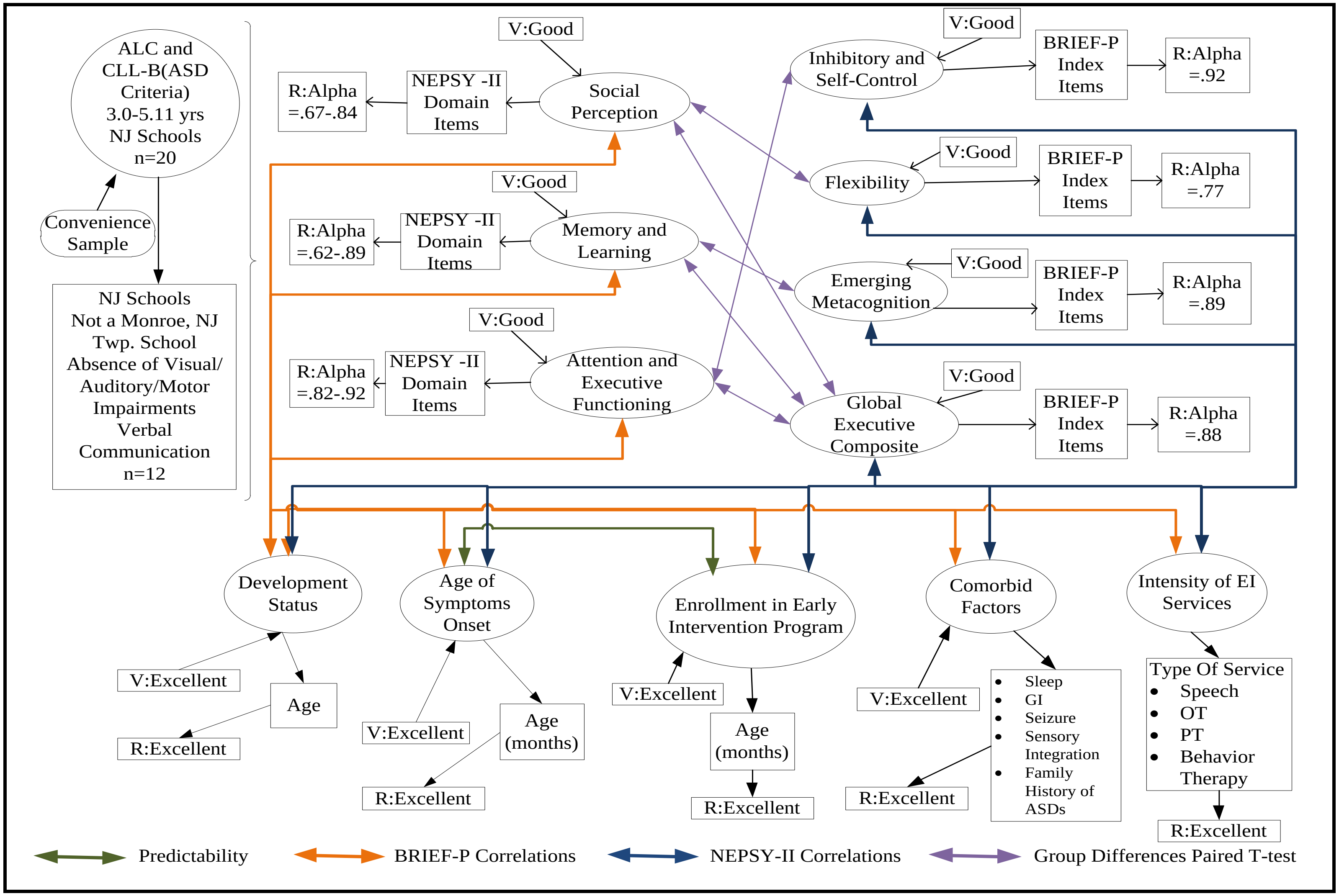

Figure 2. Research path with the relationship among the variables of age, age of symptoms onset, enrollment in EI services, intensity of services provided by early intervention, comorbid factors associated with ASDs, as well as instruments of executive functions of preschool children.

Population

Participants were recruited from two preschool programs, which service preschoolers with ASDs, namely the Academy Learning Center and the Center for Lifelong Learning. Both schools are considered specialized programs that belong to Middlesex Regional Educational Services Commission, Middlesex County, New Jersey. The participants of the study were eligible for special services under the Preschool Disabled (age 3-5 years) criteria and received their education in a self-contained program outside their home school. The primary reason for their intense level of special education services was due to the complexity and nature of their disabilities and because their home school program no longer met their educational needs. The main criterion for acceptance into this study was that the student had a diagnosis of an ASD.

Both the Academy Learning Center (ALC) and the Center for Lifelong Learning (CLL) provide specialized, classroom-based instruction based on the cognitive-behavior principles for the student with autism or "autism-like" behaviors. There were 230 students enrolled at the ALC and CLL, whose ages were between 3-21 years; however, there were 96 school-aged students with ASDs ranging from 3-21 years of age in both schools. Additionally, there were 82 males and 14 females enrolled as school-aged students at ALC and CLL. Furthermore, the population's ethnic demographics were 115 Caucasian, 59 Black, 26 Latino, and 30 Asian school-aged students receiving special education and related services at the ALC and CLL.

Students were referred to as out-of-district students, and tuition was paid by their home school district, such as Middlesex, Monmouth, and Hunterdon, among other counties. Enrolled students received comprehensive and research-based instruction including academic and developmental goals, speech-language therapy, physical therapy, occupational therapy, adaptive physical education, augmentative communication, transitional services, and parent training. The participants were drawn from this population of school-aged students, particularly preschool-aged students with ASD.

Sample

There were 20 preschool students diagnosed with ASDs attending ALC and CLL at the time of this study. Both males and females were included in this study. Even though there were no sex restrictions, the prevalence rate of preschool students with autism disorder is higher in males. More specifically, the male-to-female ratio range is from 3.4-6.5 boys to 1 girl (Fombonne, 2003) previously diagnosed with autism disorders or ASDs.

Identifying executive functions in children with ASDs can represent a challenge, particularly in children under 8 years of age. One of the most common challenges is the fact that statistics are difficult to establish due to a low number of children reported in previous studies (Vig & Jedrysek, 1999). Until the last two decades, research emphasized the importance of studying the development of EF profiles in preschool children (Denckla, 1996; Gioia & Isquith, 2004; Hughes, 1996), and this research has been pivotal in generating assumptions and inferences about young children with autism. As shown in Table 2, a growing body of research illustrates statistical aspects of current research of individuals with autism.

Table 2

Current Research of Individuals with Autism

Study	Sample Size	Age	Sex (male/ female ratio)	Instruments
Schmitt & Wodrich (2004)	30	9.3 years	19/11	WISC-III (Wechsler, 1991); NEPSY (Korkman, Kirk, & Kemp, 1998)
Hala, Rasmussen, & Henderson (2005)	17	8.5 years	11/2	PPVT (Dunn & Dunn, 1997); VECD (Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994)
Joseph, McGrath, & Tager-Flusberg (2005)	37	6 - 12 years	32/5	DAS (Elliot, 1990); PPVT-III, Dunn & Dunn, 1997); EVT (Williams, 1997); NEPSY (Korkman, Kirk, & Kemp, 1998)
Lopez, Lincoln, Ozonnof, & Lai (2005)	17	29 years	14/3	WAIS-III (Psychological Corporation, 1998); D-KEFS (Delis, Kaplin, & Kramer, 2001); WCST (Heaton, Chelune, Talley, Kay, Curtiss, 1993)

Note. M= mean; Aut- autism; ASDs= Autism Spectrum Disorders; ADHD= Attention Developmental Disorders; CANTAB=Cambridge Automated Neuropsychological Test and Battery; VECD= Variability in Early Communicative Development; WISC-III= Wechsler Intelligence Scale for Children-III; NEPSY= A Developmental Neuropsychological Assessment; BRIEF= Behavior Rating Inventory of Executive Function; VA= Vineland Adaptive Behavior; PPVT= Peabody Picture Vocabulary Test; SCWT= Stroop Color and Word Test; DAS= Differential Ability Scales; EVT= Expressive Vocabulary Test; WAIS-III = Wechsler Adult Intelligence Scale-Third Edition; D-KEFS= Delis-Kaplin Executive Functions Scale; WCST (Wisconsin Card Sorting Test).

Assignment

The assignment of participating teachers and their students was not random. Students who had received parental consent to participate in this research study received instruction from the teachers participating in the study. All students, who had given their assent and received parental consent, were included in the study. The NEPSY-II utilizes two scoring forms, one form for children 3-4 years of age and another for children 5-16 years of age. Therefore, the participants of this study were divided into two groups: preschool children with ASDs in the age group 3.0-4.11 years, and preschool children with ASDs 5.0-5.11 years.

Students, who did not meet diagnostic criteria for ASDs or autism disorder, as outlined in the inclusion criteria, were excluded from the study. Moreover, students with vision and/or hearing concerns, as specified by school records, as well as students serviced by this test administrator, were excluded from this study.

Measurement: Variables

In this research study, the variables of interest included the participant's age, age of symptoms onset, enrollment in EI services program, and comorbid factors associated with ASDs. The participant's age was defined as the chronological age at the time of the data collection. Age of symptoms onset was defined as the age when the participant was first identified as having autism-like characteristics. Age of enrollment was defined by the participant's chronological age when EI services were provided (12-18 months, 18-24 months, 24-30 months, and 30-36 months). EI services were defined as services received from birth to three years of age including speech-language, developmental intervention, occupational therapy, physical therapy, and applied behavioral services. Intensity of EI services was defined by the amount of hours provided by the EI program (occupational therapy, physical therapy, speech-language therapy, behavior therapy, developmental intervention). Comorbid factors were defined as difficulties previously diagnosed by a certified professional such as sleep disturbances (wakes-up during night sleep), gastrointestinal problems (diarrhea, vomit, constipation), seizure disorders (convulsive episodes), and family history of ASDs (i.e. sibling, parent, uncle/aunt, cousin).

Two standardized measures of executive functions were administered as dependent variables for the study. Executive functions of preschool children with ASDs were measured based on the participants' performance on the NEPSY-II (Korkman, Kirk, & Kemp, 2007) and the teacher ratings on the BRIEF-P (Gioia, Espy, & Isquith, 2003). Table 3 provides a description of the measurement variables for the current study including the research questions, latent variables, observed variables, instrument/source, validity, and reliability.

Table 3

Measurement Variables for the Executive functions of Preschool Children with ASDs Study Research: Research Questions, Latent Variables, Observed Variables, Instrument/Source, Validity, and Reliability for Questions One through Seven

Research questions	Latent variable	Observed variable	Instrument Source	Validity	Reliability
1-What is the relationship between age of symptoms onset and the age of enrollment in EI? How is age of symptoms onset related to the intensity of EI services, as defined by the amount of EI services provided from birth to three years of age?	Age of symptoms onset; Age of enrollment in EI; Intensity of EI services	Age EI	School Records	Excellent	Excellent
2- What is the relationship between age of symptoms onset and comorbid factors associated with ASDs?	Age of symptoms onset; Comorbid factors associated with ASDs	Age Comorbid factors	School Records	Excellent	Excellent
3- What is the relationship between age of enrollment in EI services and the intensity of services provided to the preschool with ASDs and the dependent variables of NEPSY-II Att/EF; ML; SP domains?	Age of enrollment in EI; Intensity of hours of services; NEPSY-II	Age Therapy services Att/EF; ML; & SP domains	School Records NEPSY-II	Excellent Good	Excellent; Reliability: Alpha= .82-.92 (Att/EF); .62-.89 (ML); .67-.84 (SP)

Note. NEPSY-II Domains: Attention and Executive Functioning (Att/EF); Memory and Learning (ML); Social Perception (SP); BRIEF-P Indexes: Inhibitory Self Control (ISCI); Flexibility (FI); Emergent Metacognitive (EMI); Global Executive Composite (GEC)

Research questions	Latent variable	Observed variable	Instrument Source	Validity	Reliability
4- What is the relationship between age of enrollment in EI services and the intensity of EI services provided to the preschool with ASDs, and the dependent variables on the BRIEF-P (ISCI, FI & EMI)?	Age of enrollment in EI; Intensity of services hours;	Age Therapy services	School Records	Excellent	Excellent
	ISCI; FI: EMI indexes	ISCI; FI; EMI BRIEF-P	BRIEF-P	Good	Reliability: Alpha= .92 (ISCI); .77 (FI); .89 (EMI)
5- Is there a significant difference between participants' performance on the Att/EF domain, the ISCI, and the GEC?	Att/EF domain	Att./ EF NEPSY-II	NEPSY-II	Good	Reliability: Alpha= .82-.92 (Att/EF)
	ISCI; GEC indexes	ISCI; GEC BRIEF-P	BRIEF-P	Good	Reliability: Alpha= .92 (ISCI); .88 (GEC)
6- Is there a significant difference between participants' performance on the ML domain, the EMI, and the GEC?	ML domain	ML NEPSY-II	NEPSY-II;	Good	Reliability: Alpha= 62-.89 (ML)
	EMI; GEC indexes	EMI; GEC BRIEF-P	BRIEF-P	Good	Reliability: Alpha= .89 (EMI); .88 (GEC)
7- Is there a significant difference between participants' performance on the SP domain, the FI, and the GEC?	SP domain	SP NEPSY-II	NEPSY-II	Good	Reliability: Alpha= .67-.84 (SP)
	FI; GEC indexes	FI; GEC BRIEF-P	BRIEF-P	Good	Reliability: Alpha= .77 (FI); .88 (GEC)

Note. NEPSY-II Domains: Attention and Executive Functioning (Att/EF); Memory and Learning (ML); Social Perception (SP); BRIEF-P Indexes: Inhibitory Self Control (ISCI); Flexibility (FI); Emergent Metacognitive (EMI); Global Executive Composite (GEC)

Instruments

A performance based-measure and a rating scale were selected to assess the executive functions in this study. Another instrument, [Comprehensive Clinical History Form (CCHF; NEPSY-II)] in this study was a measure to collect the following information such as background history, developmental milestones, EI services, other diagnosed medical conditions, age of onset and diagnostic criteria for ASDs. Table 4 lists the primary and secondary constructs of interest in this study and their corresponding measures.

Table 4

Constructs and Measures

Constructs of the Study and Measures	
Constructs	Measures
Developmental History	Comprehensive Clinical History Form, NEPSY-II
Executive Functions	NEPSY-II; BRIEF-P-Teacher

Developmental History

The investigator completed a review of the students' educational records by using the Comprehensive Clinical History Form (CCHF; NEPSY-II). Requested information on the questionnaire consisted of age, date of birth, sex, and grade level. The CCHF questionnaire also asked for information pertaining to the presence of a genetic disorder, presence of seizure disorder, history of traumatic brain injury, and use of current medications. When the developmental data was compiled, each student was given an ID code to ensure student confidentiality.

Measures of Executive Functioning

Performance-based measure. The NEPSY-II: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II) provides a flexible model for assessment of neuropsychological development in preschool and school-aged children (Korkman, Kirk, & Kemp, 2007). The NEPSY-II is theoretically divided into six sections termed "functional domains". Structurally, each domain consists of a pool of tests from which the examiner may select. The domains include attention/executive function, language, visual-spatial processing, sensorimotor, memory and learning, and social perception. The NEPSY-II uses a flexible approach to extract selected subtests depending on the referral question or participants' performances. NEPSY-II's results are expressed in standard scores, allowing a profile analysis of relative strengths and weaknesses.

At the preschool level, each student completes the following domains: the Att/EF; the ML; and the SP scales of the NEPSY-II. The subtests on the Att/EF domain include the Statue subtest for participants aged 3-4. The 5-year-old participants were administered the following subtests: Auditory and Attention Response Set; Design Fluency; Inhibition; and Statue.

The following is a description of each subtest component on the Att/EF domain. Auditory and Attention Response Set subtests have two tasks. For both tasks, the child listened to a pre-recorded auditory stimulus of a list of words and simply touched the appropriate circle. The Statue subtest required the child to maintain a motoric body position over a 75-second period, inhibiting the impulse to respond to sound distracters. The Design Fluency subtest required the child to draw designs in the response booklet by connecting two or more dots within arrays containing five dots each. The Inhibition subtest required the child to look at a series of black and white shapes or arrows and name either the shape, direction, or an alternate response, depending on the color of the shape or arrow.

The subtests on the ML domain included the following subtests for the ages from 3-4 years: Narrative Memory and Sentence Repetition. The 5-year-old participants were administered the following subtests: Memory for Designs, Memory for Faces, Memory for Names, Narrative Memory, and Sentence Repetition.

The following is a description of each subtest component on the ML domain. Memory for Faces required the child to look at a series of faces and identify the gender of each as an attention-focusing device. Then, the child was shown three faces at a time from which he or she selected the face previously seen. In Memory for Names, the child was shown six cards with drawings of children while being read each child’s name. The cards were then shown again, and the child was asked to recall the name of the child on each card. There were three learning trials. The cards were shuffled after each trial, so the sequence of the pictures was different for each one. In Narrative Memory, the child listened to a story and was then asked to repeat the story. Next, the child was asked questions to elicit details not included in his or her free recall of the story. Preschool children heard a short, simple story accompanied by a picture representing the story. In Memory for Designs, the child was shown a grid with four to ten designs on a page, which was then removed from view. The child then selected the designs from a set of cards and placed the cards on a grid in the same locations as previously shown.

The following is a description of each subtest component on the SP domain. Affect Recognition included four tasks. In the first task, the child simply stated whether or not two photographs depicted faces with the same affect. In a second task, the child selected two photographs of faces with the same affect from three or four photographs. In a third task, the child was shown a page with five faces and selected one of the four faces that depicted the same affect as a face at the top of the page. Last, the child was briefly shown a face, and from memory, selected two photographs that depicted the same affect as the face previously shown. All four tasks assessed the child's ability to recognize affect in photographs of children's faces.

In Theory of Mind, the subtest includes two tasks. In the Verbal task, the child was read various scenarios or shown pictures, and then was asked questions that required knowledge of another's individual perspective to answer correctly. These items assessed the child's ability to understand mental function such as belief, intention, deception, emotion, imagination, and pretense, as well as the ability to understand that others have their own thoughts, ideas, and feelings that may be different from one's own. In the Conceptual task, the child was shown a picture depicting a social situation in which the face of the target individual cannot be seen. The child was asked to select the photograph from four options that depicted the appropriate affect for the target individual in the picture. It assessed the child's ability to recognize facial affect and to understand how emotion relates to social context and to recognize the appropriate affect given in various social cues. Table 5 provides a description of each subtest by domain measured by this research project.

Table 5

NEPSY-II Subtests Title Abbreviations and Brief Description of Each Subtest within a Domain

Domain	Subtest	Description
Attention and Executive Functioning	Auditory Attention (AA)	Assess selective auditory attention and the ability to sustain it.
	Design Fluency (DF)	Assess behavioral productivity to generate unique designs within a time limit.
	Inhibition (IN)	Timed subtest to assess the ability to inhibit automatic responses in favor of novel responses and the ability to switch between response types.
	Statue (ST)	Assess motor persistence and inhibition.
Memory and Learning	Memory for Designs (MD)	Assess spatial memory for novel visual material.
	Narrative Memory (MF)	
		Assess encoding of facial features, as well as facial discrimination and recognition.
	Memory for Names (MN)	Assess the ability to learn the names of children over three trials.
	Narrative Memory (NM)	Assess memory for organized verbal material under free recall, cued recall, and recognition conditions
	Sentence Repetition (SR)	Assess the ability to repeat sentences of increasing complexity and length.

Note. NEPSY-II, Clinical Interpretative Manual (Korkman, Kirk, Kemp, 2007, p. 21-22).

Domain	Subtest	Description
Social Perception	Affect Recognition (AR)	Assess the ability to recognize affect (happy, sad, anger, fear, disgust, and neutral) from photograph's of children's faces in four different tasks
	Theory of Mind (TM)	Assess the ability to understand mental functions, as well as, the ability to understand that others have their own thoughts, ideas, and feelings that may be different from one's own and the ability to understand how emotion relates to social context and to recognize the appropriate affect given various social contexts

Note. NEPSY-II, Clinical Interpretative Manual ((Korkman, Kirk, Kemp, 2007, p. 21-22).

Reliability coefficients of the NEPSY-II were calculated for each subtest and across domains (Korkman, et al., 2007). Split-half reliabilities and alpha methods were calculated by dividing the subtests into two halves of equal lengths and approximate quality. In addition, stability coefficients and decision-consistency procedures were used on subtests for which the alpha and split-half methods were not appropriate. The split-half reliability coefficient was calculated using the Spearman-Brown formula. The average reliability coefficients were calculated using Fisher's z transformation. For the functional domains, the average reliabilities across age group 3-4.11 were: Attention and Executive Functioning: Statue (.82); Memory and Learning: Memory for Designs (.84), Narrative Memory (.62), Sentence Repetition (.89); and Social Perception: Affect and Recognition (.75), Theory of Mind (.76). The average reliabilities across age group 5-5.11 were: Attention and Executive Functioning: Statue (.88), Inhibition (.96), and Auditory Attention (.91); Memory and Learning: Memory for Designs (.88), Memory for Faces (.50), Memory for Names (.80), Narrative Memory (.72), Sentence Repetition (.87); and Social Perception: Affect Recognition (.67), Theory of Mind (.84).

Validity research for the NEPSY-II is limited; confident estimates regarding its validity may be premature. To this end, it is expected that future use of the NEPSY-II will lead to an expanding base of evidence for the scale's validity (Korkman, et al., 2007).

Teacher rating scale. BRIEF-P, The Behavior Rating Inventory of Executive Function-Preschool (Gioia, Espy, & Isquith, 2003), is a standardized rating scale developed to provide a profile of everyday behaviors associated with specific domains of executive functioning in children aged 2-5.11 years including children with emergent learning disabilities and attentional disorders, pervasive developmental disorders, and other developmental, neurological, and medical conditions. The BRIEF-P consists of a single rating form designed to be completed by parents, teachers, and other caregivers, with 63 items in five non-overlapping clinical scales that measure different aspects of executive functioning. Raw score responses are converted to T-scores, and higher T-scores indicate an increased degree of executive function difficulties.

The five clinical scales are Inhibit, Shift, Emotional Control, Working Memory, and Plan/Organize. In addition, the combination of the scales forms three indexes: Inhibitory Self-Control (ISCI), Flexibility (FI), and Emergent Metacognitive (EMI), as well as the Global Executive Composite (GEC). Gioia, et al., (2003) indicated that the combination of the scales and indexes is based on the assumption that these regulatory functions are, to a certain degree, related to each other. A summary GEC combines all five scales of the BRIEF-P (Gioia, et al., 2003).

The BRIEF-P scales have demonstrated usefulness in clinical diagnosis and assessment outcome in a range of conditions, such as ASDs in preschool children (Isquith, Gioia, & Espy, 2003). The published literature using the

BRIEF-P includes several studies of test validity and a variety of applications in the study of diverse samples defined by presenting problem or diagnosis (Espy, Kaufmann, & Glisky, 1999; McEvoy, Rogers, & Pennington, 1993; Welsh, & Pennington, 1988; Welsh, Pennington, Ozonoff, Rouse, & McCabe, 1990). Descriptions of the clinical scales on the BRIEF-P, taken directly from the BRIEF-P manual, are provided to define the constructs each scale attempts to assess (Gioia, Espy, & Isquith, 2003). Table 6 provides a brief description of the BRIEF-P scales and indexes.

Table 6

Description of BRIEF-P scales and indexes

Scale or Index	Subtest	Description
Clinical Scales	Shift	Assess the ability to move freely from one situation, activity, or aspect of a problem to another.
	Inhibit	Assess inhibitory control and the ability to stop his or her own behavior at the appropriate time.
	Plan/Organize (PO)	Assess the ability to manage current and future-oriented task demands within the situational context.
	Emotional Control (EC)	Assess the ability to modulate emotional responses.
	Working Memory (WM)	Assess the ability to hold information in mind for the purpose of completing a task or making a response.
Indexes	Inhibitory Self-Control (ISCI)	Represents the ability to modulate actions, responses, emotions, and behavior via appropriate inhibitory control.
	Flexibility (FI)	Represents the ability to move flexibly among actions, responses, emotions, and behavior.
	Emergent Metacognitive (EMI)	Represents the developing ability to initiate, plan, organize, implement, and sustain future-oriented problem-solving.
	Global Executive Composite (GEC)	Summarizes all five clinical scales of the BRIEF-P.

Note. BRIEF-P, Professional Manual (Gioia, Espy, Isquith, 2003, p. 17-19).

Inhibit. The Inhibit scale assesses the participants' inhibitory control (i.e., the ability to inhibit, resist, or not to act on an impulse) and the ability to stop his or her own behavior at the appropriate time. This is a well-studied behavioral regulatory function that is described by clinicians as an ability to inhibit inappropriate physical responses to others.

Shift. The Shift scale assesses the participants' ability to move freely from one situation, activity, or aspect of a problem to another, as the circumstances demand. Deficits in the ability to shift can compromise the efficiency of problem solving, reduce the ability to make easy transitions, and change focus from one mindset or topic to another. Researchers observed that a change in normal routine may elicit repetitive inquiries about what is going to happen next or when a postponed event will occur. Other children may have specific repetitive or stereotypic behaviors that they are unable to stop. The DSM-IV diagnostic criteria for Pervasive Developmental Disorders (PDD) include poor shifting ability.

Emotional Control. The Emotional Control scales measure the manifestation of executive functions within the emotional realm and measures a participants' ability to modulate emotional responses. Poor emotional control can be expressed as emotional liability or emotional explosiveness.

Working Memory. Items in the Working Memory scale measure the participants' ability to hold information in mind for the purpose of completing a task or making a response. Working memory is essential for carrying out multi-step activities, implementing a sequence of actions, or following complex instructions.

Plan/Organize. The Plan/Organize scale assesses the participants' ability to manage current and future-oriented tasks and demands within the situation's context. The plan component of this scale relates to the ability to anticipate future events, implement instructions, and develop appropriate steps ahead of time in order to carry out a task or activity. The organization component of this scale relates to the ability to bring order to information, actions, or materials in order to achieve an objective. Difficulty with organization and planning is integral to many cases of executive dysfunction.

Procedures

Recruitment. The first part of the study was an initial mailing of parental consent forms, as well as a follow-up two weeks later to those parents who had not returned the original consent form to their school. This mailing process was completed by the school on the investigator's behalf. The investigator provided all mailing supplies to each school including cover letter, consent letter, developmental history forms, and self-addressed envelopes to be returned. A second mailing system followed one week later, if the first consent letters had not been returned to the students' school. Once consent forms were received, the investigator gathered the students' educational and developmental history via a review of the students' school record. Requested information on the questionnaire consisted of age, date of birth, sex, developmental milestones, educational level, and medical conditions (CCHF; NEPSY-II). Once the developmental data had been compiled, each student was given an ID code to ensure student confidentiality.

The second part of the study included a mailing to each preschool teacher of children with ASDs, including a teacher consent form, which explained the scope, time-line, confidentiality, and voluntary nature of their participation. The consent form described the benefits of the study and stated their participation had no affiliation with their job responsibilities and/or duties to the Center for Lifelong Learning or the Academy Learning Center. All correspondence was mailed on IUP letterhead. All teachers of students, whose parents consented, were asked to complete the Brief Rating Inventory of Executive Functioning Skills- Preschool (BRIEF-P), a 63-item checklist which took approximately 10-15 minutes to complete. A copy of the BRIEF-P protocol was provided. This protocol was completed by the students' teacher during non-instructional time. Teachers, who participated in the study, were given a $20.00 gift certificate to Barnes and Noble.

Lastly, the investigator scheduled the administration of the NEPSY-II during the participants' regular school day, without interruption to their related services. The test battery consisted of an administration of three domains from the NEPSY-II: A Developmental Neuropsychological Assessment-2nd Edition (Korkman, Kirk, & Kemp, 2007). Each student completed the following domains of the NEPSY-II: Att/EF, ML, and SP.

A schedule of testing was distributed to each participating teacher so that staff could plan accordingly for testing times. Test administration took place over a five-week period with the primary investigator testing each day. During this time period, the primary investigator was assisted by the classroom paraprofessional in order to minimize difficulties. This investigator coordinated with the school principal for a quiet, well-ventilated room for testing purposes. Children were escorted by the classroom paraprofessional to the testing room. Based on teacher recommendation, a small reinforcer (i.e., toy, sticker) was offered to the student while transitioning to the testing room. The entire test battery was estimated to take between 30-45 minutes. Also, necessary breaks in between the administration of the subtests were offered to the student. These breaks were allowed to address any fatigue issues and ensure optimal results. Test administration guidelines were followed according to the NEPSY-II examiner's manual, and each student was given a $5.00 gift card to Barnes & Noble for their participation.

All research data were treated ethically and confidentially, in accordance with the ethical guidelines of the APA (American Psychological Association, 2002). All data were collected upon approval by Indiana University of

Pennsylvania's Institutional Review Board and in accordance with Indiana University of Pennsylvania's policies of Human Subjects Protection Committees. See Table 7 for the timeline pertaining to study procedures.

Table 7

Timeline Procedures Covering the 2008-2010 School Years

Date	Study process
June 2008	Secure study approval from Middlesex Regional Educational Services Commission, specially to conduct study at Academy Learning Center and Bright Beginnings Learning Center; Bright Beginnings Learning Center-Annex (Bright Beginnings programs re-located to Center for Lifelong Learning)
June 2008	Submit and secure IRB approval
October 2008	Approval to conduct research was received by this researcher from Dr. Finkelstein, superintendent Middlesex Regional Educational Services Commission
February 2010	School Staff (i.e., principal, teacher, secretary) consultation on the study procedures; consultation with Dr. Finkelstein on available programs for preschool students with ASDs
March-April 2010	Hand-deliver parent and teacher consent forms to schools
April-May 2010	Informed consent forms received from parents and teachers
May 2010	Scheduled and completed test administration with students and their teachers
June 2010	Data gathering through test protocols & clinical questionnaire
June 2010	Researcher scores and enters the obtained data by using the SPSS computerized program
July-August 2010	Dissertation project revisions by Committee
September 2010	Complete final recommendations by Committee
October 2010	Final defense
March 2011	Submit final copy to School of Graduate Studies and Research

Power and Sample Size

Currently, there is limited research literature exploring the relationship between deficits in EF and individuals with autism, particularly in preschool children with autism. Previous research studies have relied on a limited number of individuals previously identified as having ASDs as participants in studies of executive functions and other neuropsychological functions. See Table 8 for a description of previous studies examining the neuropsychological functions of individuals with ASDs and reported age and sample size.

Table 8

Previous Studies on Neuropsychological Functions on Individuals with ASDs and Reported Age and Sample Size

Study	Sample Size	Developmental Disability	Executive functions investigated	Effect Size
Mahone, Koth, Cutting, Singer, & Denckla (2001)		ADHD; TS	Inhibition; organization	.5 to .8
Willcutt, Doyle, Nigg, Faraone, & Pennington (2005)	Varied-Meta-analysis studies	ADHD	Response inhibition; set-shifting vigilance; working memory; planning.	.5
Marton (2008)	105	LI	Working memory.	.5
Sinzig, Morsch, Bruning, Schmidt, Lehmkuhl (2008)	40	AD; ADHD	Inhibition; flexibility; working memory; planning.	.5

Note. ADHD=Attention Deficit Hyperactivity Disorder; TS=Tourette Syndrome; LI=Language Impairment; AD=Autism Disorder

Previous neuropsychological studies (Mahone, et al., 2001; Willcutt, et al., 2005; Marton, 2008; & Sinzig, et al., 2008) reported a medium effect size (.5-.8) to explore neurocognitive profiles (i.e., inhibition, organization, working memory, set-shifting) in individuals with developmental disabilities such as ADHD, TS, and AD. The previous research cited above provided a rationale for the proposed effect size and power in the current study. Additionally, guidelines provided by Cohen (1992) proposed that research studies in the behavioral sciences utilize the power size of .80 and an alpha level of .05 to balance between Type I and Type II error. In order to control for Type I error, the researcher performed a Bonferroni correction, which calls for dividing the pre-selected alpha level (α=.05) by the number of tests to be conducted. Given the limited number of students enrolled at the participating programs and the reduced number of participants, who received consent to participate in this project, a power analysis was not conducted to detect significant differences between groups. Both a review of prior research and Cohen's (1992) guidelines for behavior research served the basis for establishing power values.

Statistical Analysis

For this research project, data analysis procedures included Pearson correlation, linear regression analysis, and paired T-test. The data measuring executive functions of the groups were examined by Pearson correlation, linear regression analysis, and paired T-tests. An alpha level of .05 was used for all statistical procedures with the exception of the analyses between the participant's performance on the NEPSY-II domains and the BRIEF-P indexes, for which a .02 alpha level was used. See Table 9 for research questions, hypotheses, variables, statistical analysis, and statistical assumptions for the Executive Functions of Preschool Children with ASDs. Additionally, this research study used raw and standardized data derived from the dependent measures for analysis. All standardized data were analyzed by a computerized program, the Statistical Package for the Social Sciences for Windows 17.0 (SPSS 17.0). The research questions included:

1- What is the relationship between age of symptoms onset and the age of enrollment in EI services? How is age of symptoms onset related to the intensity of EI services, as defined by the amount of EI services provided from birth to three years of age? It was hypothesized that no significant relationship existed between age of symptoms onset and age of enrollment in EI services. The variables examined in this question were age of symptoms onset, age of EI enrollment, and intensity of EI services, as defined by the amount of services provided from birth to three years of age. Person correlations and linear regression analysis were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

2- What is the relationship between age of symptoms onset and comorbid factors associated with ASDs? It was hypothesized that no significant relationship existed between age of symptoms onset of preschool children presenting with ASDs and comorbid factors (i.e., sleep disturbances, gastrointestinal problems, seizure disorder, sensory integration dysfunction, family background of ASDs). The variables examined in this question were age of symptoms onset and comorbid factors (i.e., sleep disturbances, gastrointestinal problems, seizure disorder, sensory integration dysfunction, family background of ASDs). Person correlations were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

3- What is the relationship between age of enrollment in EI services, the intensity of services provided to the preschool with ASDs, and the dependent variables of NEPSY-II: Attention and Executive Functioning, Memory and Learning, and Social Perception domains? It was hypothesized that no relationship existed between age of enrollment in EI services, the intensity of services provided, and the participants' performance on the NEPSY-II Attention & Executive Functioning (Att/EF), Memory & Learning (ML), Social Perception (SP). The variables examined in this question were age of enrollment in EI services, intensity of services, as defined by the amount of services provided from birth to three years of age, and the participants' performance on the NEPSY-II (Attention & Executive Functioning, Memory & Learning, and Social Perception) domains. Person correlations were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

4- What is the relationship between age of enrollment in EI services, the intensity of EI services provided to the preschool with ASDs, and the dependent variables on the BRIEF-P (ISCI, FI & EMI)? It was hypothesized that no significant relationship existed between age of enrollment in EI services, intensity of services provided, and the participants' performance on the BRIEF-P (Inhibitory Self-Control Index (ISCI); Flexibility Index (FI); Emergent Metacognitive Index (EMI). The variables examined in this question were age of enrollment in EI services, intensity of services, as defined by the amount of services provided from birth to three years of age, and the participants' performance on the BRIEF-P (Inhibitory Self-Control, Flexibility, Emergent Metacognitive) indexes. Person correlations were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

5- Is there a significant difference between participants' performance on the Attention and Executive Functioning, the Inhibitory Self-Control Index, and the Global Executive Composite? It was hypothesized that no significant differences existed between results from the Attention and Executive Functioning (Att/EF), the Inhibitory Self Control Index (ISCI), and the Global Executive Composite (GEC). The variables examined in this question were the participants' performance on the Attention and Executive Functioning, the Inhibitory Self Control Index, and the Global Executive Composite. Paired T-tests were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

6- Is there a significant difference between participants' performance on the Memory and Learning, the Emergent Metacognitive Index, and the Global Executive Composite? It was hypothesized that no significant differences existed between results on the Memory and Learning (ML), the Emergent Metacognitive Index (EMI), and the Global Executive Composite (GEC). The variables examined in this question were the Memory and Learning (ML), the Emergent Metacognitive Index, and the Global Executive Composite. Paired T-tests were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

7- Is there a significant difference between participants' performance on the Social Perception, the Flexibility Index, and the Global Executive

Composite? It was hypothesized that no significant differences existed between results from the Social Perception (SP), the Flexibility Index (FI), and the Global Executive Composite (GEC). The variables examined in this question were the Social Perception, the Flexibility, and the Global Executive Composite indexes. Paired T-tests were the statistical method of analysis. The assumptions of interval/ratio data, normality, linearity, and equal variance were examined and determined to be acceptable.

Table 9

Research Questions, Hypotheses, Variables, Statistical Analysis, and Statistical Assumptions for the Executive Functions of Preschool Children with ASDs

Research questions	Hypotheses	Variables	Statistic	Assumptions	Assumptions questions
1- What is the relationship between age of symptoms onset and the age of enrollment in EI services? How is age of symptoms onset related to the intensity of EI services, as defined by the amount of EI services provided from birth to three years of age?	No significant relationships exist. No predictive relationships exist.	Age of symptoms onset; Age of enrollment in EI; Intensity of EI services	Pearson; Linear Regression	Interval/Ratio; Normality; Linearity; Hom. of Variance	Examine Instruments; Descriptive Statistics; Visual Inspection; Visual Inspection
2- What is the relationship between age of symptoms onset and comorbid factors associated with ASDs?	No significant relationships exist.	Age of symptoms onset; Comorbid factors associated with ASDs	Pearson	Interval/Ratio; Normality; Linearity; Hom. of Variance	Examine Instruments; Descriptive Statistics; Visual Inspection; Visual Inspection
3-What is the relationship between age of enrollment in EI services and the intensity of services provided to the preschool with ASDs and the dependent variables of NEPSY-II Att/EF, ML, and SP?	No significant relationships exist.	Age of enrollment in EI; Intensity of hours of services; NEPSY-II domain	Pearson	Interval/Ratio; Normality; Linearity; Hom. of Variance	Examine Instruments; Descriptive Statistics; Visual Inspection; Visual Inspection

Note. A Developmental Neuropsychological Evaluation-Second Edition (NEPSY-II, Korkman, Kirk, & Kemp, 2007); Behavior Rating Inventory of Executive Functioning-Preschool Version (BRIEF-P, Gioia, Espy, & Isquith, 2003); Inhibitory Self-Control Index (ISCI); Flexibility Index (FI); Emergent Metacognitive Index (EMI); Global Executive Composite (GEC).

Research questions	Hypotheses	Variables	Statistic	Assumptions	Assumptions questions
4- What is the relationship between age of enrollment in EI services and the intensity of EI services provided to the preschool with ASDs, and the dependent variable of BRIEF-P (ISCI, FI, & EMI)?	No significant relationships exist.	Age of enrollment in EI; Intensity of services hours; BRIEF-P Indexes	Pearson	Interval/Ratio; Normality; Linearity; Hom. of Variance	Examine Instruments; Descriptive Statistics; Visual Inspection; Visual Inspection
5- Is there a significant difference between the participants' performance on Att/EF, ISCI, and GEC?	No significant differences exist.	Att/EF domain ISCI; GEC Indexes	Paired T-test; Bonferroni correction	Interval/Ratio Normality Hom. of Variance Sample Size	Examine Instruments; Descriptive Statistic Charts/Histogram "Rules of Thumb"
6- Is there a significant difference between the participants' performance on ML, EMI, and GEC?	No significant differences exist.	ML domain EMI; GEC Indexes	Paired T-test; Bonferroni correction	Interval/Ratio Normality Hom. of Variance Sample Size	Examine Instruments; Descriptive Statistic; Charts/Histogram; "Rules of Thumb"
7- Is there a significant difference between the participants' performance on SP, FI, and GEC?	No significant differences exist.	SP domain FI; GEC Indexes	Paired T-test; Bonferroni correction	Interval/Ratio Normality Hom. of Variance Sample Size	Examine Instruments; Descriptive Statistic Charts/Histogram "Rules of Thumb"

Note. A Developmental Neuropsychological Evaluation-Second Edition (NEPSY-II, Korkman, Kirk, & Kemp, 2007); Behavior Rating Inventory of Executive Functioning-Preschool Version (BRIEF-P, Gioia, Espy, & Isquith, 2003); Inhibitory Self-Control Index (ISCI); Flexibility Index (FI); Emergent Metacognitive Index (EMI); Global Executive Composite (GEC).

Summary

The methods and procedures of this study were presented and discussed. The scope and purpose of each of the instruments were discussed along with a comprehensive description of the research participants and research design.

A total of 12 preschool students participated in this study, from a possible population of 20 preschool students diagnosed with ASDs. Both males and females were included in this study. Participants were recruited from two programs that service preschool children with ASDs. Both schools were considered specialized programs that belong to Middlesex County, New Jersey. The participants of the study were eligible for special services under the Preschool Disabled (age 3-5 years) criteria and received their education in a self-contained program outside of their home school. The researcher utilized a static group comparison design. This study utilized a convenience sample. This study compared age, EI services, and learning profiles, particularly executive functions. Also, this study explored the relationship between the participants' performance on subtests of the NEPSY-II (Korkman, Kirk, & Kemp, 2007) and on the teacher ratings of executive functions based on the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P, Gioia, Espy, & Isquith, 2003).

CHAPTER IV

RESULTS

Introduction

This chapter outlines the results of the data-analysis procedures stated in the Methods chapter. Throughout the course of this project, a number of complications were documented and are discussed in this chapter. This comparative project attempted to answer seven research questions, which had the primary purpose of comparing specific neurocognitive profiles of preschool-aged children with autism based on their performance on the Attention and Executive Functioning (Att/EF), the Memory and Learning (ML), and the Social Perception (SP) domains of the NEPSY: A Developmental Neuropsychological Evaluation-2nd Edition (NEPSY-II, Korkman, Kirk, & Kemp, 2007). Additionally, this project intended to determine whether age of symptoms onset, age of enrollment in early intervention (EI) services, and comorbid factors differentiated the profiles of these students regarding learning, particularly executive functions. Furthermore, this project explored the relationship between the participants' performance on these same subtests of the NEPSY-II and teacher ratings of executive functions based on the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P, Gioia, Espy, & Isquith, 2003).

Complications of the Study

The study sample was composed of preschool students with a diagnosis of Autism Spectrum Disorders (ASDs). The preschool students were enrolled in an out-of-district placement due to the complexity of their disabling condition and because their home school program no longer met their academic needs. Both out-of-district schools enrolled classified students from 3-21 years in Middlesex County, New Jersey. A total of 20 preschool students meeting the diagnostic criteria of ASDs were enrolled in these programs. Originally, all preschool students were invited to participate in this study, with consideration of the exclusionary criteria stated on the Institutional Review Board submission. Students, who had previously been serviced by this researcher or identified by their school nurse as having safety concerns due to visual, auditory, or motor difficulties, would not participate in this investigation. As a result, one student was excluded for these reasons. Two students were reported to have poorly developed language skills, including picture identification, signs, and spoken vocabulary, and due to these deficits they were excluded. Furthermore, one student had transferred to one of these programs less than a week before testing started; therefore due to adjustments to a new school setting, the student was excluded from the study sample.

This researcher issued parental consent notices two weeks apart (see appendix B). One consent form was not returned, and three consent forms indicated that the parents did not consent to their child's participation. Thus, this study sample consisted of 12 preschool students with ASDs. All three teachers from both out-of-district programs returned their consent forms, which indicated their participation (see appendix C).

A sex variable was originally included in this study; however, this variable was eliminated as part of the data-analysis process due to the low number of female participants. Eleven males and 1female participated in the study. All teachers who completed a rating scale for each of the students were females. As in previous studies, a limited sample was reported for this study, resulting in restricted generalization that could be made with the statistical data obtained. Thus, statistical components, such as power analyses, were adversely impacted by the reduced number of participants of this study.

Computer Program to Analyze the Research Questions

This researcher used the Statistical Package for the Social Sciences 17.0 (SPSS, 17.0) to analyze all quantitative data collected for this study.

Data Analysis

Demographic Information of the Sample

The participants of this study were eligible for special education services under the Preschool Disabled (age 3-5 years) criteria and received their education in a self-contained program outside their home school. Prior to their placement in the out-of-district program, these children received comprehensive assessments by their physicians (i.e., neurodevelopmental pediatrician, neurologist). Based on behaviorally-based characteristics impacting their development, these participants met the diagnostic criteria of ASDs. The primary reason for the specialized services was due to the complexity of their disabling condition; therefore, their home school program no longer met their educational needs.

For the purpose of the test administration, the participants were divided into two age groups. Seven participants ranged in age from 36-59 months, and five participants ranged in age from 60-72 months.

The age of symptoms onset was a variable that refers to the time when the participants' primary caregiver or physician first reported concerns with the participants' development. The age of symptoms onset in the sample ranged from 12 to 30 months, with a mean of 21.33 months.

Intervention Services and Comorbid Factors of the Sample

Due to behaviorally-based concerns, all participants had been referred to receive EI services. A total of five parents/guardians initiated a referral process, while seven primary physicians were considered the initial source of referral. Once the participants were identified as eligible to receive EI services, their primary caregivers completed the enrollment with EI. Based on this study sample, the age in months of enrollment in EI services ranged from 18-34 months, with a mean of 26 months. Based on the participants' needs and eligibility for therapeutic services, the following services were provided: speech therapy (58%), occupational therapy (91%), physical therapy (16%), developmental therapy (33%), and behavioral therapy (50%). Based on a review of records, the sample presented with the following comorbid factors: gastrointestinal problems (GI) (41%), seizure disorder (16%), sleep disturbances (16%), sensory integration diagnosis (75%), and documentation of a family member with a diagnosis of autism (41%).

Statistical Assumptions

In order to establish normality of the data collected, frequency distributions were computed for all variables. Visual inspection of data points were conducted by examining histograms, which revealed relatively consistent normality for developmental age, age of symptoms onset, age of enrollment in EI services, intensity of EI services, comorbid factors, and performance on the NEPSY-II and BRIEF-P scales. Visual inspection of data and histograms revealed positively skewed distributions for the three domains of the NEPSY-II (Attention and Executive Functions, Memory and Learning, and Social Perception) and for the BRIEF-P Indexes (Inhibitory Self-Control, Flexibility, Emergent Metacognitive, and Global Executive Composite). In addition, linearity of the data was established through visual inspection of scatter plots of standardized residuals.

Research Question One

Analysis of data for the first research question focused on investigating the relationship between age of symptoms onset and the age of enrollment in EI services. Additionally, this analysis explored the relation between age of symptoms onset and the intensity of EI services, as defined by the amount of EI services provided to the child. The researcher's hypothesis was that there was no relationship between age of symptoms onset and the age of enrollment in EI services. The variable age of symptoms onset was established based on the age in months of when initial characteristics associated with ASD were reported by the participants' parent/guardians or primary physicians. Table 10 shows descriptive statistics for the two variables explored in this first question, and the results from a Pearson product-moment correlation coefficient between the age of symptoms onset and the age of enrollment in EI services. There was a strong, positive correlation between the two variables, $r = .931$, n = 12, $p < .01$ level. The analysis of the first question yielded a rejection of the null hypothesis. A significant, positive interaction was found.

Table 10

Results of Correlations between Age of Symptoms Onset and Age of Enrollment in EI Services

Descriptive Statistics

Variables	M	SD	Range Min	Range Max
Age of Symptoms Onset in months	21.3	5.2	12	30
Age of Enrollment in EI services	25.9	5	18	34

Note. N=12

Pearson Product-Moment Correlations

Variable		Age of Symptoms Onset in Months
Age in Months of Enrollment in EI services	*R*	.931**
	p, two-tailed	<.001
	N	12

Note. ***p* < 0.01, two-tailed

In order to establish the predictive relationship between earlier onset of symptoms of ASDs and intensity of EI services, a simple linear regression analysis was computed. Intensive EI services were defined by the amount of EI services provided to the child with autism. Table 11 demonstrates the regression model of the age of symptoms onset and the intensity of EI services provided to the child eligible for services. The analysis indicated that the regression equation was not significant (*F* (1, 11) = 1.89, $p > .05$) with an R^2 of .075.

Table 11

Results of a Regression Model on Age of Symptoms Onset and the Intensity of EI Services Provided to the Child Eligible for EI Services

Descriptive Statistics

Variables			Range	
	M	SD	Min	Max
Age of Symptoms Onset	21.3	5.2	12	30
Intensity of EI Services	5.3	2.3	2	9

Note. N=12

Regression Analysis Predicting Intensity of EI Services

Source of Variation	Sum of Squares	Df	Mean Square	F	*p*
Regression	9.98	1	9.98	1.89	.19
Residual	52.68	11	5.26		

Model Fit	*R*2	Adjusted *R*2
F (1, 11) = 1.89; *p* > .19	.15	.07

Research Question Two

In order to answer the second research question, the researcher explored the relationship between age of symptoms onset and comorbid factors associated with ASDs. Studies of children with ASDs demonstrated that earlier presentations of characteristics compatible with ASDs were often accompanied by the presentation of comorbid conditions (Fombonne, 2003). However, this researcher hypothesized that age of symptoms onset of preschool children presenting with ASDs and comorbid conditions (i.e., sleep disturbances;

gastrointestinal problems; seizure disorder; sensory integration dysfunction; family background of ASDs) would not show a significant relationship. The relationship between participants' age of symptoms onset and participants' comorbid factors was calculated using a Pearson product-moment correlation coefficient. A significant statistical relationship was not found between the two variables. The analysis of the data for the second question failed to reject the null hypothesis. Table 12 shows descriptive statistics for the two variables explored for this second question, and the results from the Pearson product-moment correlation coefficient between the age of symptoms onset and comorbid factors associated with ASDs.

Table 12

Results of Correlations between Age of Symptoms Onset and Comorbid Factors

Descriptive Statistics

Variable	*M*	*SD*	Range Min	Range Max
Age of Symptoms Onset in Months	21.3	5.2	12	30
Sleep	.1	.3	0	1
GI	.4	.5	0	1
Seizures	.1	.38	0	1
Sensory	.7	.45	0	1
Family Member with ASD	.4	.51	0	1

Note. n=12

Pearson Product-Moment Correlations

Variables		Sleep	GI	Seizures	Sensory	Family member Autism
Age of Symptoms Onset	*r*	-.029	.111	-.118	-.228	-.223
	p, two-tailed	.928	.730	.715	.475	.486
Sleep	*r*		.529	-.200	-.258	.076
	p, two-tailed		.077	.533	.418	.815
GI	*r*			.076	.098	.314
	p, two-tailed			.815	.763	.320
Seizures	*r*				.258	.076
	p, two-tailed				.418	.815
Sensory	*r*					.098
	p, two-tailed					.763

Note. n=12

Research Question Three

The researcher's third question investigated the relationship between age of enrollment in EI services, the intensity of EI services provided to the child with ASDs, and the dependent variables of NEPSY-II Attention and Executive Functioning, Memory and Learning, and Social Perception domains. Table 13 shows descriptive statistics for the five variables explored for this third question.

Also shown are the results from a Pearson product-moment correlation coefficients among the age of enrollment and intensity of EI services provided and the students' profile on the NEPSY-II (Attention & Executive Functioning Memory & Learning, and Social Perception). It was hypothesized that age of enrollment in EI services and intensity of EI services provided would not show a relationship with the students' profiles on the NEPSY-II. The dependent variables required to answer this question included the following:

1. The Attention and Executive Functioning domain scores of the NEPSY-II; subtests include Auditory Attention, Design Fluency, Inhibition, and Statue.
2. The Memory and Learning domain scores of the NEPSY-II; subtests include Memory for Designs, Memory for Faces, Memory for Names, Narrative Memory, and Sentence Repetition.
3. The Social Perception domain scores of the NEPSY-II; subtests include Affect Recognition and Theory of Mind.

Table 13

Results of Correlations between Age of Enrollment, Intensity of EI Services, and NEPSY-II Domains

Descriptive Statistics

Variable	M	SD	Range	
			Min	Max
Age of Enrollment on EI Services	25.9	5	18	34
Intensity of EI Services	2.5	.9	1	4
NEPSY-II Attention and EF Domain	21.5	8.5	10	36
NEPSY-II Memory and Learning Domain	34.8	9.8	24	61
NEPSY-II Social Perception Domain	21.7	8.8	5	32

Note. N=12

Pearson Product-Moment Correlations

Variable		Attention/EF	Memory Learning	Social Perception
Age of Enrollment in EI Services	*r*	.19	-.40	-.14
	p, two tailed	.54	.19	.65
Intensity of EI Services	*r*	.64*	.18	.46
	p,two tailed	.02	.56	.12

Note. n=12; ***p** < .05, two-tailed

The relationships among participants' age of enrollment, intensity of EI services, and the results from the participants' performance on the NEPSY-II Att/EF, ML, and SP domains were analyzed using Pearson product-moment correlation coefficients. A significant statistical interaction was not found between the age of enrollment in EI services and the students' performance on the NEPSY-II Att/EF performance. The interaction between these variables indicated that the analysis of the data for the third question failed to reject the null hypothesis. On the other hand, a Pearson product-moment correlation was calculated to investigate the relationship between the intensity of EI services provided and the students' performance on the NEPSY-II Att/EF domain. The analysis found a significant positive relationship between these variables, $r = .64$, n = 12, $p < .05$. Thus, the null hypothesis was rejected.

The relationships among participants' age of enrollment, intensity of services hours, and the results from the participants' performance on the NEPSY-II ML domains were examined using Pearson product-moment correlation coefficients. A significant statistical interaction was not found between participants' age of enrollment in EI services, intensity of EI services, and performance on the NEPSY-II ML domain performance. The lack of interaction between these variables indicated that the analysis of the data for the third question failed to reject the null hypothesis.

The relationships among participants' age of enrollment, intensity of EI services, and the results from the participants' performance on the NEPSY-II SP domain were examined using Pearson correlations. A significant statistical interaction was not found between the age of enrollment in EI services, intensity of EI services, and the students' performance on the NEPSY-II SP Domain. The interactions among these variables indicated that the analysis of the data for the third question failed to reject the null hypothesis.

Research Question Four

The researcher's fourth question sought to explore the relationships among age of enrollment in EI services, intensity of EI services provided to the child with ASDs, and the dependent variables on the BRIEF-P (ISCI, FI, & EMI).

Table 14 illustrates descriptive statistics for the three variables explored on this fourth question. Also shown are the results from a Pearson product-moment correlation among the age of enrollment in EI services, intensity of EI services provided to the child with ASDs, and the students' profile on the BRIEF-P (ISCI, FI, & EMI). It was anticipated that the null hypothesis would be rejected due to the scarcity of research documenting relationships among the three variables: age of enrollment in EI, intensity of services provided to the child with ASDs, and the results of a teacher rating scale, the BRIEF-P (ISCI, FI, & EMI). The dependent variables used in this question included the following:

1. The Inhibitory Self-Control Index (ISCI) is composed of the Inhibit and Emotional Control scales.
2. The Flexibility Index (FI) is composed of the Shift and Emotional Control scales.
3. The Emergent Metacognitive Index (EMI) is composed of the Working Memory and Plan/Organize scales.

Table 14

Results of Correlations between Age of Enrollment, Intensity of EI Services, and the BRIEF-P Indexes

Descriptive Statistics

Variable	M	SD	Range Min	Max
Inhibitory Self-Control	65.6	11.5	55	85
Flexibility	62.4	13.3	41	80
Emergent Metacognitive	71.8	7.7	61	84

Note. n=12

Pearson Product-Moment Correlations

Variable		EMI	ISCI	FI
Age of Enrollment in EI Services	*r*	.60*	.23	.15
	p, two tailed	.03	.46	.62
Intensity of EI Services	*r*	-.46	-.55	-.47
	p, two-tailed	.12	.05	.12

Note. n=12; ***p** < .05, two-tailed

The relationship between participants' age of enrollment in EI services and the result's from the participants' performance on the EMI (as measured by the BRIEF-P) was investigated using Pearson product-moment correlation coefficient. There was a strong, positive correlation between the two variables, $r = .609$, n = 12, $p < .05$. The analysis of the first part of the fourth question yielded a rejection of the null hypothesis.

The relationships among participants' age of enrollment in EI services, intensity of EI services, and participants' score on ISCI (as measured by the BRIEF-P) were investigated using Pearson product-moment correlation coefficients. There was no significant statistical correlation among the three variables, which resulted in a failure to reject the null hypothesis.

Last, the fourth question looked at the relationship between participants' age of enrollment in EI services and participants' score on FI (as measured by the BRIEF-P). Results were calculated using a Pearson product-moment correlation coefficient. There was no significant statistical correlation between the two variables, which resulted in a failure to reject the null hypothesis.

Research Question Five

The researcher's fifth question examined whether there was a statistically significant difference between the participants' performance on the Attention and Executive Function (Att/EF) domain of the NEPSY-II, the Inhibitory Self-Control Index (ISCI), and the Global Executive Composite (GEC) on the BRIEF-P. It was hypothesized that the results from Att/EF and the results on ISCI and GEC would not indicate significant differences, which would result in a failure to reject the null hypothesis.

Table 15 presents the results of a paired-samples t-test conducted to compare the participants' performance on Att/EF (as measured by the NEPSY-II), ISCI, and GEC (as measured by the BRIEF-P). The alpha level was set at .05, and a Bonferroni adjustment (Shaffer, 1995) was made by dividing .05 by the number of t-tests. The results are presented in Table 15. An alpha level of .017 was used (.05 level divided by two tests). The hypothesis was supported. There was not a statistically significant difference between the Att/EF and ISCI scores (M = -.22, SD = .64) and Att/EF and GEC scores (M = 1.15, SD = .58); t (11) = -.41; -1.95 respectively. These results suggested further evidence is needed to conclude that the scores of Att/EF domain, ISCI, and GEC on the BRIEF-P for preschool children with ASD are different. Specifically, the analysis suggested that the executive functioning (as measured by the Att/EF, ISCI, and GEC) profile for a preschool child with ASD does not demonstrate differences when compared with results from a performance-based measure and teachers' ratings.

Table 15

Paired T-tests on the Attention and Executive Function Domain, the Inhibitory Self-Control Index, and the Global Executive Composite

Scale/Index	Mean	SD	Range of the Differences Min	Max	t	*r*	*p*
Att/EF-ISCI	-.22	.64	-1.68	1.15	-.41	-.20	0.68
Att/EF-GEC	1.15	.58	-2.44	.14	-1.95	-.33	0.07

Note. *n=12; df= 11*

Research Question Six

The researcher's sixth question examined whether there was a statistically significant difference between the participants' performance on the Memory and Learning (ML) domain on the NEPSY-II, and the Emergent Metacognitive Index (EMI) and the Global Executive Composite (GEC) on the BRIEF-P. It was hypothesized that the results from ML and the results on FI and GEC would not indicate significant differences, which would result in a failure to reject the null hypothesis.

Table 16 presents the results of paired-samples t-tests conducted to compare the participants' performance on ML (as measured by the NEPSY-II), EMI and GEC (as measured by the BRIEF-P). The alpha level was set at .05, and a Bonferroni adjustment (Shaffer, 1995) was made by dividing .05 by the number of t-tests. The results are presented in Table 16. An alpha level of .017 was used (.05 level divided by two tests). The null hypothesis was rejected. There was a statistically significant difference between the ML and EMI scores (*M* = 1.65, *SD* = 2.01) and ML and GEC scores (*M* = 1.71, *SD* = 2.21); *t* (11) = 2.83; 2.68 respectively. These results suggested that the executive functioning profiles (as measured by ML, EMI, and GEC) for preschool children with ASDs demonstrated differences when comparing results from a performance-based measure and teachers' ratings.

Table 16

Paired t-tests on the Memory and Learning Domain, the Emergent Metacognitive Index, and the Global Executive Composite

Scale/Index	Mean	SD	Range of the Differences *Min*	*Max*	t	*r*	*p*
ML-EMI	1.65	2.01	.36	2.98	2.83	-.40	0.01
ML-GEC	1.71	2.21	.31	3.12	2.68	-.49	0.02

Note. *n=12; df= 11*

Research Question Seven

The researcher's seventh question examined whether there was a statistically significant difference between the participants' performance on the Social Perception (SP) domain of the NEPSY-II, Flexibility Index (FI), and Global Executive Composite (GEC) on the BRIEF-P. It was hypothesized that the results from SP, FI, and GEC would not indicate significant differences, which would result in a failure to reject the null hypothesis.

Table 17 presents the results of paired-samples t-tests conducted to compare the participants' performance on SP (as measured by the NEPSY-II), FI and GEC (as measured by the BRIEF-P). The alpha level was set at .05, and a Bonferroni adjustment (Shaffer, 1995) was made by dividing .05 by the number of t-tests. The results are presented in Table 17. An alpha level of .017 was used (.05 level divided by two tests). The hypothesis was supported for the analysis looking at differences between SP and FI, but the hypothesis was not supported for the analysis looking at differences between SP and GEC. There was not a statistically significant difference between the SP and FI scores (M = 1.80, SD = 2.77); t (11) = -.54; and there was a statistically significant difference between SP and GEC scores (M = .96, SD = 2.46); t (11) = -.62. These results suggested further evidence is needed to conclude that the scores of the SP domain on the NEPSY-II and the Flexibility Index of the BRIEF-P for preschool children with ASDs are different. Specifically, the analysis results suggested that the executive functioning (as measured by SP and FI) profile for a preschool child with ASDs did not demonstrate a difference when compared with results from a performance-based measure and teachers' ratings.

Table 17

Paired T-tests on the Social Perception Domain, the Flexibility Index and the Global Executive Composite

Scale/Index	Mean	SD	Range of the Differences Min	Max	t	*r*	*p*
SP-FI	1.80	2.77	.04	3.56	.25	-.54	0.04
SP-GEC	.96	2.46	-.59	2.53	1.36	-.62	0.20

Note. *n=12; df= 11*

Summary

The researcher's first hypothesis investigated the relationship among age of symptoms onset and the age of enrollment in EI. Additionally, the researcher explored the predictive relationship between age of symptoms onset and the intensity of EI services. The researcher's hypothesis was that there was no relationship between age of symptoms onset and intensity of EI services. The analysis of the first question resulted in a rejection of the null hypothesis. A significant, positive relationship was found. In order to establish the predictive relationship between earlier onset of symptoms of ASDs and the intensity of EI services, a simple linear regression analysis was computed. The analysis indicated that the regression equation was not significant.

The researcher's second hypothesis explored the relationships among age of symptoms onset and comorbid factors associated with ASDs. A significant statistical relationship was not found between the age of symptoms onset and any of the comorbid factors.

The researcher’s third question investigated the relationships among age of enrollment in EI services, the intensity of EI services provided to the participant with ASDs, and the dependent variables of NEPSY-II Att/EF, ML, and SP domains. A significant statistical relationship was not found between the age of enrollment in EI services and the students’ performance on the NEPSY-II Att/EF, ML, and SP domains. Additionally, there were no significant relationships among intensity of EI services and the students’ performance on the NEPSY-II (ML & SP) domains. The relationships among these variables indicated that part of the third question resulted in failure to reject the null hypothesis. On the other hand, there was a significant positive relationship found between the intensity of EI services provided and the students’ performance on the NEPSY-II Att/EF. Thus, the null hypothesis was rejected.

The researcher’s fourth question explored the relationships among age of enrollment in EI services, intensity of EI services provided to the child with ASDs, and the dependent variables on the BRIEF-P (ISCI, FI, & EMI). Based on the results of the analysis, the hypotheses were partially supported for two out of three components. The relationship between age of enrollment in EI services and the participants’ profile on EMI indicated a significant correlation.

The researcher’s fifth question examined whether there were statistically significant differences among the participants’ performance on the Att/EF domain of the NEPSY-II, ISCI, and GEC on the BRIEF-P. It was hypothesized that the results from Att/EF and the results on ISCI and GEC would not indicate significant differences, which would result in a failure to reject the null hypothesis. Specifically, the analysis suggested that the executive functioning (as measured by Att/EF, ISCI, and GEC) profile for a preschool child with ASDs demonstrated no differences when comparing results from a performance-based measure and teachers' ratings.

The researcher's sixth question examined whether there was a statistically significant difference between the participants' performance on the ML domain on the NEPSY-II, EMI, and GEC on the BRIEF-P. The null hypothesis was rejected. These results suggested that the executive functioning profiles (as measured by the ML, EMI, and GEC) for a preschool child with ASDs demonstrated a differences when compared with results from a performance-based measure and teachers' ratings.

The researcher's seventh question explored whether there were statistically significant differences among the participants' performance on SP domain of the NEPSY-II, FI, and GEC on the BRIEF-P. The hypothesis was supported for the analysis examining differences between SP and FI, but the hypothesis was not supported for the analysis examining differences between SP and GEC. These results suggested that the executive functioning (as measured by SP and FI) profile for a preschool child with ASDs demonstrated no difference when comparing results from a performance-based measure and teachers' ratings.

CHAPTER V

DISCUSSION

This chapter discusses the relevant findings based on the analyses for the seven research questions postulated for this study. Also, complications and limitations are discussed, and the impact of these limitations on the outcomes of this study is presented. Lastly, recommendations for future research are indicated.

The purpose of this study was to compare specific neurocognitive profiles of preschool-aged children with Autism Spectrum Disorders (ASDs) based on their performance on the NEPSY-II: A Developmental Neuropsychological Assessment-Second Edition (NEPSY-II, Korkman, Kirk, & Kemp, 2007) and teachers' ratings on the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P, Gioia, Espy, & Isquith, 2003). Additionally, this study explored whether age of symptoms onset, age of enrollment in early intervention (EI) services, and intensity of EI services provided differentiated profiles regarding learning, particularly executive functions of preschool children with ASDs. While the number of epidemiological studies investigating the wide-ranging patterns of neuropsychological characteristics in individuals with ASD is high (Centers for Disease Control and Prevention; Filipek, et al., 1999; Fombonne, 1999), there is limited research available describing sets of neuro-cognitive strengths and deficits that have been exhibited by young individuals with autism (Griffith, et al., 1999; Pennington, et al., 1997; Pennington & Ozonoff, 1996). Moreover, the relationship between performance-based measures of executive functions and teacher rating scales based on everyday behavioral manifestations has not yet been clearly documented for preschoolers with ASDs (Griffith, et al., 1999; Pennington, et al., 1997; Pennington & Ozonoff, 1996).

The researcher's first hypothesis intended to explore the relationship between age of symptoms onset and the age of enrollment in EI services. Also, the researcher sought to explore the predictive relationship between age of symptoms onset and the intensity of EI services. The relationship between age of symptoms onset and the age of enrollment in EI services demonstrated a strong positive correlation. The increasing movement toward better understanding and awareness of providing early support services to children identified as having autism-like tendencies has been previously documented by the Centers for Disease Control and Prevention (CDC-2007) and the National Institute of Mental Health (NIMH-2007). During the last decade, there has been a high awareness of early markers of autism-like symptoms and better consultation among parents, primary physicians, and other educational facilities, which have been essential in providing early and consistent support services to children with special needs. This progress is demonstrated in the results of this analysis.

Filipek, et al. (1999) stated that the wide-range of characteristics of ASDs manifests themselves quite differently depending on age of symptoms onset and the developmental level of the child. Certainly, many more parents/caregivers have raised initial concerns to their primary care physicians, which demonstrate a positive indication of better coordination, awareness, and efforts to support the community of parents, whose children present with developmental disabilities (Filipek, et al., 1999; Fombonne, 1999). During the last ten years, an imperative need to initiate intensive EI with children with ASDs during their early childhood years was evident. These services increased the potential for better overall life-long outcomes for most children, facilitated earlier educational planning, and provided parents with easier acceptance, emotional support, and increased advocacy on behalf of their child (Filipek, et al., 2000).

Based on a review of the students' educational records, this researcher found that 75% of the study sample had received a comorbid diagnosis of a Sensory Integration Dysfunction, and 91% received occupational therapy services as part of their EI program. These findings were consistent with previous neuropsychological studies (Joseph, 1999; Pennington & Ozonoff, 1996; Volkmar, et al., 1994), which have attributed "autism-like" characteristics to specific skill deficits or to sensory-perception, attention, memory, and executive functions. Additionally, Bertrand and colleagues (2001) and Williams, Goldstein, and Minshew (2006) proposed that sensory difficulties seem to be hampered by the child's difficulties to register, organize, and process large amounts of information. Furthermore, evidence shows that delays in other developmental areas, such as adaptive functioning, social communication, and memory functioning, may be affected as well. While deficits in the participants' sensory system had been found to be one of the strongest markers of developmental disorders, intensive and tailored therapy services have shown success in improving aspects of joint attention, sensory processing, and social engagement in individuals with autism (Williams, Goldstein, & Minshew, 2006).

The researcher's second hypothesis sought to explore the relationship between age of symptoms onset and comorbid factors associated with ASDs. The results of the current study found no interaction between the two variables. Interestingly, based on a review of each of the participants' educational records, this researcher found the following comorbid factors: sensory integration disorder (75%), gastrointestinal problems (42%), family member (i.e., siblings, parents, uncle, aunt, and or cousins) (42%) with a diagnosis of ASDs, a seizure disorder (16%). Even though the results for this question did not yield statistical significance, it is important to consider the concept of comorbid factors, since the severity of autism may be associated with the presentation of comorbid factors (Muhle, Trentacoste, & Rapin, 2004).

As previously documented by Rutter (2000), both medical and mental health professionals need to be aware of the increasing number of children presenting with ASDs and other medical conditions. Tuberous sclerosis and Fragile X syndrome are medical conditions that account for 10% of children with ASDs. Similar to the current study, Tuchman and Rapin (2002) found that three to thirty percent of children with ASDs also suffered from one type of seizure disorder. This study found that five of the twelve participants had been diagnosed with gastrointestinal (GI) conditions, which was a similar finding to previous research by Drevets and Schulkin (2003). While the authors concluded there was little evidence to suggest that individuals with autism were prone to gastrointestinal (GI) symptoms such as diarrhea, constipation, or food intolerance, those children with GI problems showed greater symptom severity on measures of irritability, anxiety, and social withdrawal.

Furthermore, Fombonne (2003) supported previous findings on the association between autism-like tendencies and the presentation of comorbid factors. Fombonne explained that those children, who present with autism earlier in their development, have demonstrated cognitive impairments, with about a third falling in the mild range of cognitive impairments, and more than a third (40%) falling in the severe to profound range of mental retardation. Moreover, the author stated that the assessment of cognitive skills in individuals with autism must be analyzed with caution because these children may show uneven development with a high discrepancy among skills, such as a marked delay in verbal skills, and average or above average spatial or visual motor skills. This researcher completed a review of the students' educational records and found that documentation in regard to cognitive assessment from performance-based instruments was not found. It is important to re-state that the sample of the current study was composed of preschool children, who presented with moderate to severe characteristics of autism, given the fact that their home school district was not able to provide them with the teacher to student ratio and intensity of services per their educational programs. Thus the likelihood is that they were experiencing at least mild cognitive delays.

Lastly, this study found that five of twelve participants had a family member (two siblings, one parent, and one uncle) with a diagnosis of autism. This finding was consistent with previous studies by Fombonne (2003) and Ritvo, Pingree, and Mason-Brothers (1989), which found that genetic factors associated with autism increased over the last two decades. In response to the increasing concerns of autism and genetic factors, the CDC (2007) indicated that there was a higher probability (2 to 8%) of a second family member presenting with manifestations of a ASDs.

While the research on the direct association between autism-like manifestations and comorbid factors is scarce, and this association has yet been found to be an influence on diagnostic or intervention practices, Hansen and Hagerman (2003) recommended that a comprehensive medical history be completed with an emphasis on medical conditions known to be related to autism, possibly including immune dysfunction (e.g., frequent infections), autoimmune disorders (e.g., thyroid problems, arthritis), allergy history (e.g., foods or environmental triggers), and gastrointestinal symptoms (e.g., diarrhea, constipation, bloating). The limited sample size and age range of the current study participants may be a factor in the lack of significant findings.

The third research hypothesis investigated the relationship between age of enrollment in EI services and intensity of EI services provided to the children with ASDs, and the dependent variables of NEPSY-II Att/EF, ML, and SP domains. The results of the current study did not find a significant relationship between the age of enrollment in EI services and the participants' performance on the NEPSY-II Att/EF, ML, and SP domains. Additionally, there was no significant relationship between the intensity of EI services and the participants' performance on the NEPSY-II ML and SP domains. Although the results of the current research did not find significant relationships, previous researchers documented that youngsters, who failed to demonstrate prerequisite skills for complex learning such as pretend play, gaze-monitoring, and intentional pointing, by 18 months of age were considered at-risk for receiving a diagnosis of autism (Baron-Cohen, et al., 1996).

As previously stated by Baron-Cohen and colleagues, 10 out of 12 toddlers, who failed to demonstrate typical characteristics, were later diagnosed with autism; the same 10 toddlers were re-assessed at three and a half years of age, and their diagnosis remained the same. Similarly, Dawson and colleagues (1998) found that difficulties in the social domain such as poor eye contact, failure to engage in imitative games, and lack of imitative vocal responses by 12 months of age, were all important risk factors for autism. Previous research suggested that the participants' age of symptoms onset, the developmental level at which the child exhibited autism-like behaviors, and the recommendations for EI services were considered significant factors for diagnostic and intervention purposes, and eventually for program planning for children with ASDs. The limited sample size and age range of the current study may be a factor in the lack of significant findings.

An interesting finding was that the relationship between the intensity of EI services provided and the students' performance on the NEPSY-II Att/EF was found to be significant. The relationship indicated that the more intensive EI services lower the student's scores on the Att/EF domain, an indicator of the child's ability to monitor, ability to self-regulate, nonverbal problem solving, planning, and organizing a complex response. This finding was consistent with past research from Damasio and Maurer (1978), who found a relationship between type and severity of autism and development of future interventions. Moreover, advocates of early identification (Filipek, Accardo, Baranek, Cook, Dawson, Gordon, et al., 1999; Harris & Handleman, 2000; Lord, 1995) documented improved developmental outcomes in children with autism, who had received tailored interventions. Harris and Handleman (2000) concurred that intensive EI services provided during the first five years of the child's development increased the probability for later acquisition of social, communication, and cognitive skills. These findings were considered best practices in the diagnosis and intervention for young children with autism given the fact that many researchers (Filipek, et al., 1999; Harris & Handleman, 2000; Lord, 1995) had postulated that intensive EI addressed specific needs in young children presenting with autism tendencies and improved their overall learning potential.

The fourth research question studied the relationship between age of enrollment in EI services, the intensity of services provided to the child with ASDs, and the dependent variables of the BRIEF-P (ISCI, FI, & EMI). Based on the results of the analysis, the hypotheses were partially supported on two out of three components. The relationship between indicated a significant correlation of earlier age of enrollment in EI services with highly elevated EMI scores at the .05 probability level. As proposed, the relationships among age of enrollment in EI services, intensity of EI, ISCI, and FI were not significant. A possible explanation for the lack of significance on this research question may be related to a previous study by Isquith, Gioia, and Espy (2004). These authors found that children with disabilities exhibited weaknesses in executive functions more than neuro-typical children across all EF domains examined, as rated by their teachers. In contrast, their teachers rated them as demonstrating scores within the significant range for the inhibition scale. Isquith, Gioia, and Espy attributed this discrepancy to a higher degree of structure in preschool classrooms, which may have limited the expression of disinhibition in that specific setting.

On the other hand, a study completed by Mackinlay, Charman, and Karmiloff-Smith (2006) was consistent with the findings of a positive relationship between age of enrollment in EI services and the participant's profile on EMI, a measure of the child's ability to plan, organize, and solve future-oriented problems. The authors found that the group with ASDs exhibited more difficulties with their self-control in their daily lives when the study associated their chronological age, sex, and the developmental age of manifestation of symptoms. Specifically, the results of the BRIEF-P profile demonstrated elevated scores in the ability to plan, perform multiple tasks, switch from multiple tasks, and inhibit rule-breaking behavior. Mackinlay and colleagues discussed that this profile appears to be consistent with the neurocognitive profile of EF in older individuals with ASDs. While the results of this research question were not consistently significant, previous authors had provided empirical support that both versions (parent and teacher) of the BRIEF were valid everyday measures of executive functions (i.e., working memory, flexibility, and inhibition), which differentiated such concerns during the preschool years of the child's development across environments (Espy, Kaufman, McDiarmid, & Glisky, 1999; Hughes, 1996).

The researcher's fifth question examined possible differences between the participants' performance on the Att/EF domain of the NEPSY-II, the ISCI, and the GEC on the BRIEF-P. The results of the current study did not find a statistically significant difference between the scores from Att/EF, ISCI, and GEC for preschool children with ASDs. These results were consistent with previous research, which found that developmentally appropriate assessments of executive functioning such as the self-report BRIEF-P and the performance-based instrument NEPSY-II, contained a number of theoretically defined constructs designed to assist with interventions and early educational planning for young children with disorders of executive function (Gioia, Espy, & Isquith, 2003;

Korkman, Kirk, & Kemp, 2007). Korkman, Kirk, and Kemp found children with autism exhibited compromised areas of development across all domains assessed; specifically, within the Att/EF domain, measures of sorting, cognitive flexibility, and auditory attention were impaired. As previously stated, the complexity and range of neurocognitive skills and deficits presented in children with ASDs, combined with the nature and limitations of traditionally used measures of EF for the age group, make understanding preschool children with ASDs especially challenging (Klin, Chawarska, Rubin, & Volkmar, et al., 1994). Consistent with past research, Kanner (1943) postulated that delays presented in children with autism were observable across developmental stages. Later, Hill (2004) established that even though EF was considered a set of complex, neurocognitive skills, it was pivotal to acknowledge their hierarchical development from early childhood to late adolescence.

Attentional difficulties in children with ASDs were well researched (Klin, et al., 2004; Osterling, et al., 2002; Volkmar, Chawarska, & Klin, 2005). Both the level and degree of difficulties presented in ASDs depended upon the child's ability to establish and sustain attention, maintain joint attention, and filter attention in settings with multiple stimuli, in particular auditory stimuli (Osterling, et al.). Preschool children with autism might encounter more difficulties in establishing and sustaining their attention with people than with objects (Dawson, et al., 1998), as evidenced in part by their tendency to look at and play with objects rather than people. Klin, et al. (2004) found that delays in the development of social attention were evidenced by the child's marked inabilities to attend to people's faces, as compared to neuro-typical peers. In an attempt to provide an explanation for such early differences, Klin, et al. suggested that children with autism tended to avoid complex visual stimuli (e.g., faces) or unpredictable and variable social stimuli.

As documented by Isquith, et al. (2005) executive functioning regulates complex brain-based behaviors, which encompass the child's ability to use metacognitive skills for problem solving, modulate emotional responses at the appropriate time and setting, establish and sustain attention, and plan and organize a complex response. The results of this research question did not find significant differences between the results obtained based on the teachers' ratings on ISCI as measured by the BRIEF-P, and on the performance-based assessment of Att/EF as measured by the NEPSY-II. The literature comparing children's scores based on rating scales and performance-based assessments remains scarce. However, there is well-documented research that proposes a combination of instruments and assessment opportunities, individually administered within the child's natural environment. Within this natural environment, the young child is able to explore, imitate, and respond to environmental demands (Isquith, et al., 2005). Preschool children with complex neurocognitive delays need additional time to adjust and respond to a familiar environment. Their skills for self-control and emotional regulation are not well developed and are further compromised by their diagnosis of ASDs (Isquith, et al., 2005).

Based on the results obtained by the current study, the sample scored as follows on the assessment components: Att/EF domain (M= 1.96 scaled score), ISCI (M=2.23 scaled score), and GEC (M=3.11 scaled score), which fell within the "well below expected level" classification. Overall, the results suggested significant deficits in areas of attention, problem-solving, flexibility, emergent metacognition, and inhibitory self-control, which reflected the impact of ASDs and indicated specific deficits of executive functioning. These findings were consistent with previous findings from Senn, Espy, and Kaufmann (2004). These authors stated the emergence of executive functions in early development was interrelated with complex problem solving, working memory, inhibition, and set-shifting processes. Senn and colleagues concurred that in younger children, inhibition was the strongest predictor of problem solving; whereas, working memory contributed more strongly in older children.

As proposed by Welsh and Pennington (1988), although many authors have linked inhibitory behaviors to deficits of ADHD, individuals diagnosed with ASDs also presented characteristics compatible with an inhibitory deficit. In fact, some inhibition of executive functions was considered a primary deficit when defining symptoms of ASDs (Russell, Jarrold, & Henry, 1996; Senn, Espy, & Kaufmann 2004). As proposed by Ozonoff (1997), the third set of symptoms in the ASDs triad—restrictive, repetitive, and stereotypical behaviors—was associated with deficits of inhibition. Ozonoff stated that due to the heterogeneous nature of symptoms of ASDs, many of the repetitive and restrictive behaviors associated with ASDs appeared to be different according to the child's developmental and cognitive level.

The researcher's sixth question examined whether was a statically significant difference between the participants' performance on the ML domain, on the NEPSY-II, the EMI, and the GEC on the BRIEF-P. The results of the current study found significant differences among the scores of ML domain, EMI, and GEC for preschool children with ASDs. The results of the current study found that the executive functioning profiles, as measured by ML, EMI, and GEC, demonstrated differences when comparing results from a performance-based measure and teachers' ratings. Previous research has found that developmentally appropriate assessments of executive functioning were reliable measures essential for identification, intervention, and early educational planning for young children with executive function difficulties (Gioia, Espy, & Isquith, 2003; Korkman, Kirk, & Kemp, 2007).

Based on the results obtained in the current study, the sample scored as follows on the following components: ML (M= 4.83 scaled score), EMI (M= 3.18 scaled score), and GEC (M=3.11 scaled score), which ranged from the "well below expected level" to the "below expected level" of classification. Overall, the results suggested significant deficits in areas of verbal and nonverbal memory and learning, visual and spatial recognition, ability to acquire, retain, and access novel knowledge, and ability to initiate, plan, and organize. The results also suggested significant deficits in working memory skills. Specifically, Baddeley

(2002) postulated that working memory plays an essential role in cognitive activities such as learning, comprehending, and reasoning, and also impacts social interaction due to the need to integrate constantly changing context-specific information (Bennetto, et al., 1996). Roberts and Pennington (1996) demonstrated that children with autism performed much lower than other children with learning disabilities on tasks that measured planning and organization and required working memory. This was true as well for tasks that required maintaining a mental representation and processing responses simultaneously.

Regarding the ability of children with ASDs to acquire and use new information, a study conducted by Nydén, Carlsson, Carlsson, and Gillberg (2004) supported the view that the performance of children with ASDs appears to be negatively impacted by the processing and transferring of novel information. A more recent study was found to be consistent with the current research. Kenworthy, Black, Wallace, Ahluvalia, Wagner, and Sirian (2005) compared the ratings on the BRIEF with a sample group of 72 children with high-functioning autism. Kenworthy and colleagues found that the sample presented global EF deficits. The authors' findings supported previous research that indicated deficits of EF, specifically in planning and organization, were most prominent in a sample of individuals with autism.

The researcher's seventh question examined differences between the participants' performance on SP domain of the NEPSY-II, FI, and GEC on the BRIEF-P. The results of the current study did not find a statistically significant difference between the scores of SP domain, FI, and GEC for preschool children with ASDs. These results were consistent with previous research, which found that developmentally appropriate assessments of executive functioning contained a number of theoretically defined constructs designed to assist with interventions and early educational planning for young children with disorders of executive function (Liebermann, et al., 2007). Liebermann and colleagues (2007) examined the effect of executive functions and social cognition on individual differences in emotion regulation (ER) in preschool children. The authors administered a battery of EF tasks and two Theory of Mind (ToM) tasks. In addition, parents completed the Behavior Rating Inventory of Executive Functioning-Preschool (BRIEF-P). Liebermann and colleagues concluded that the performance on the ToM tasks, as well as parental ratings of executive function and a specific component of EF (i.e., inhibition), were significantly correlated with children's performance during executive functioning and emotional regulation tasks.

Based on the results obtained by the current study, the sample scored as follows on the following components: SP (M= 4.08 scaled score), FI (M= 2.27 scaled score), and GEC (M=3.11 scaled score), which ranged from the “well below expected level” to the “below expected level” classification. Overall, the results suggested significant deficits of social cognition, which involved the ability to evaluate and modify one’s behavior and responses in accordance with previous observations, and the ability to interpret nonverbal communication. Social-behavioral regulation was an important component to modulate behavioral and emotional reactions according to different response contingencies and environmental demands (Gioia, Espy, & Isquith, 2003). Similarly, Korkman, Kirk, and Kemp (2007) proposed that delayed social relatedness, social aversion, disinterest in social interaction, and poor social abilities were significant indicators of characteristics presented by children with ASDs. Additionally, past research provided support to these research findings. Bennetto, et al. (1996) and Ozonoff, et al. (2004) stated that deficits in executive functions seemed to contribute to social difficulties in ASDs. Bennetto, et al. explained that individuals with autism exhibited pronounced social skill difficulties given the fact that social interactions were related to the ability to discriminate among stimuli, categorize stimuli according to previously learned concepts, inhibit responses, establish and sustain attention to stimuli, and use verbal feedback to change a desired behavior.

Baron-Cohen, et al. (2000) explained that individuals with ASDs demonstrated difficulties judging another individual's thoughts or perspectives, which may appear as a lack of empathy or lack of awareness of another person's mental status. However, the difficulties may also be explained by an inability to determine how to respond to another's mental states or differentiate between abstract words or concepts. Moreover, Baron-Cohen, et al. (2000) suggested that individuals with autism typically deal with social-emotional situations by applying explicit rules or cognitive strategies they learned from past experiences, rather than by identifying and responding to the unique nature of each situation in a flexible way. In summary, emotional regulation deficits potentially affected the individual's ability to maintain attention, inhibit responses, and establish and maintain peer relationships (Griffith, et al., 1999). Ozonoff, Pennington, and Rogers (1991) considered emotional regulation challenges to be a primary deficit of executive functions in individuals with autism.

Additionally, the results of this study were supported by a previous study by Gilotty, Kenworthy, Sirian, Black, and Wagner (2002). The authors investigated deficits in executive functions and the everyday social behavioral difficulties in children with autism. Gilotty and colleagues emphasized the importance of metacognitive executive abilities including communication, play, and social relationships, when developing intervention and educational planning for children with ASDs. One of the most predominant markers of ASDs is social difficulties (Volkmar, et al., 1994). Typically, preschool children with autism fail to demonstrate social skills during the first months of life (Klin, et al., 2004). Eye contact is limited, as is overall social engagement and responsivity. Klin, et al. found marked delays in the area of joint attention; such behavior is essential in the development of communicative and social-cognitive abilities. Across the child's lifetime, imitation and response for joint attention do improve in children with autism (Klin, et al.), but they continue to be impacted in natural settings.

In a recent study, Korkman, Kirk, and Kemp (2007) supported the results obtained in this research, which indicated that children with autism demonstrated more difficulties within the SP domain when compared to the control group. The authors explained that nearly 70% of children with autism obtained lower scores in Theory of Mind tasks, as compared with 10% of the control group. The NEPSY-II standardization studies revealed a global impact on EF in children with ASDs. Korkman and colleagues suggested that primary deficits in executive functioning (i.e., language and memory) had a ripple effect in other cognitive domains (e.g., auditory attention, cognitive flexibility, and self-control).

Internal and External Threats

There were a number of factors that may have threatened the internal validity of this research. Even though this researcher made attempts to secure a data collection site with a large sample size, the specialized schools available were re-districted at the time of data collection. Both the sample size and sample selection process posed a threat to the internal validity of this research. Randomization of the sample was not possible. This research was based on a convenience sample of the population. Initially, this researcher planned to match the sample size by chronological age, sex, and type of ASDs. However, once the researcher confirmed the possible amount of students available and the consents received, the sample size became a challenge, and matching of the sample was not possible. The uniqueness of the population of preschool children with ASDs often yielded research with a small sample size. This researcher reviewed recent studies of executive functions in children with autism, which cautioned the interpretation and generalizability of the results due to reported small sample sizes

(Griffith, Pennington, Wehner, & Rogers, 1999; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Schmitt & Wodrich, 2004).

The teachers who participated in the completion of the BRIEF-P were given verbal and written directions to follow when rating the students' behaviors. However, the teachers' level of expertise or training possibly impacted the rating outcome. While the students, who participated in this research, were not able to assent to participation in this study, their parents gave their consent for allowing their child to take part in the testing procedures. This process of parental consent for the child's participation in the study may represent a threat of history. The child may have experienced subtle changes, which may have altered their behavioral responses in some way. The sample selection process did not consider the following variables: baseline of cognitive and socio-emotional skills prior to the start in the child's current educational setting, socio-economic status, racial-ethnic background, specific information on the quality of previous and current therapy services (i.e., intensity of services and other type of interventions) and other instructional programs in the continuum of special education (i.e., inclusive settings that are self-contained within the home school), which were considered threats to external validity. Given the factors that may have posed internal and external threats to validity, the results of this research should be interpreted with caution.

Recommendations for Future Research

This study used a quantitative design to explore the relationship between age of symptoms onset, age of enrollment in EI, intensity of EI services, and the children's performance on the NEPSY-II and on teacher ratings of executive functions based on the BRIEF-P. The findings offered a model for future researchers in investigating the connection between performance-based assessments and rating scales when exploring executive functions in young children with developmental disabilities. Future research should further investigate the extent of the interactions between these variables. While this study provided predictive relationship information, this study did not intend to establish causation. Future research utilizing path analysis strategies would add to this existing work.

The current study recognized one of the most important shifts in the field of psychology, which emphasized data-based decision-making assessment practices with valid and reliable instruments, but ultimately future research should focus on providing school professionals with the utilization of data-based assessment to improve the coordination and implementation of tailored interventions for individuals displaying early warning signs of ASDs (Joseph, 1999; Minshew, et al., 1997; Pennington & Ozonoff, 1996). Additional research into the coordination services among parents, school professionals, and physicians may shed light onto the child's degree of progress or regression of skills necessary for the development of complex brain-based learning skills.

Previous studies supported the use of a data-driven, ecological perspective to children's everyday behavior (Isquith, Crawford, Espy, & Gioia, 2005), particularly when focusing on preschool children with disabilities and their neuropsychological profiles. The present study shared the limitations found in previous studies of children with autism. While the increased interest in the identification of complex psychological processes was evidenced through the literature review, particularly with executive functions of preschool children, this researcher recommends specific research on the population of children with autism and their performance on instruments such as the NEPSY: A Developmental Neuropsychological Assessment-2nd Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007) and the Behavior Rating Inventory of Executive Functions-Preschool (BRIEF-P; Gioia, Espy, & Isquith, 2003). Also, it is important to explore other developmentally oriented and research-based instruments, when identifying neuropsychological profiles in young children with autism. An additional recommendation for future research would be to include a randomized criterion for variables such as participants' age, comorbid factors, and interventions received. While the sample of students utilized in this study was appropriate, consideration should be given to an investigation of preschool children's performance through the continuum of specialized programs as mandated by IDEIA. Future research should explore alternate means of investigating the study variables (e.g., age, interventions, and comorbid conditions).

Conclusions and Summary

This chapter presented a discussion of the results, which were interpreted within the framework of previous research findings. In addition, the limitations of the present study, as well as recommendations for future research directives, were presented. In conclusion, the present study supported the most recent quantitative research, which emphasized the heightened need to exercise our profession from a research-based paradigm in which data drives and monitors the development of specialized interventions with a diversity of learning styles. Every day, school professionals advocate for team-based relationships with parents, educators, and related private practitioners, who are faced with the challenges of providing quality interventions to young children with developmental disabilities.

Recently, the National Institute of Mental Health (2007) emphasized that an integrative and comprehensive paradigm of determining an individual's unique pattern of learning, based on a neuropsychological model of assessment, may improve tailored and effective EI practices for young children with ASDs. The need for implementing data-driven interventions generated an increased amount of research devoted to the investigation of complex neuropsychological learning profiles, as well as to the link between assessment practices and the development of specialized interventions for young children with ASDs. A paradigm shift in assessment-intervention practices may lead to comprehensive assessment processes and use of empirical data translates into practical implications for interventions at an earlier developmental stage (Filipek, et al., 1999; Harris, et al., 1991; Harris & Handleman, 2000; Lord, 1997). As mandated by federal and state regulations, this transition was essential to build a framework that facilitated the coordination of interventions focused on individual neuropsychological profiles, particularly of executive functions of preschool children with ASDs.

While the focus of the current study was on the relationship between age of symptoms onset, age of enrollment in EI services, the intensity of EI services, the children's performance on the NEPSY-II, and teacher ratings of executive functions based on the BRIEF-P, the predictive relationship of age of symptoms onset and the intensity of EI services were also considered. The study discussed essential findings drawn from the analysis of the study.

Results of the current study found a positive relationship between the age of symptoms onset and the age of enrollment in EI services. While the existing literature documented a transition towards a better understanding and awareness of providing early therapy services to children identified as having developmental disabilities, this study focused on preschool-aged children with an existent diagnosis of ASDs, which added to the existing literature. Additionally, this research discussed that 75% of the sample received a comorbid diagnosis of a Sensory Integration Dysfunction, and later 91% of the sample met the criteria to receive occupational therapy services as part of their EI therapy program. While the study results were consistent with previous neuropsychological studies which have attributed "autism-like" characteristics to specific skill deficits, such as joint attention and visual processing skills, or to sensory-perception, attention, memory, and executive functions (Joseph, 1999; Pennington & Ozonoff, 1996; Volkmar, et al., 1994), the current study emphasized the significance of providing a comprehensive intervention process based on each child's specific needs, particularly during early childhood years.

Pertaining to EI services for children with ASDs, the current research found that children who received intensive therapy prior to the start of their specialized programs at school obtained lower scores on the Att/EF domain. Intensive EI services were related to more difficulties for self-regulation, nonverbal problem-solving tasks, and planning and organization of complex responses.

One of the most salient focuses of the current study was to compare the participants' performance on the NEPSY-II with the teacher ratings on the BRIEF-P. The results of the study were consistent with previous research, which found that developmentally appropriate assessments of executive functioning, such as the NEPSY-II and the BRIEF-P, contained a number of theoretically-defined constructs designed to plan and monitor interventions for young children with executive function disorders (Gioia, Espy, & Isquith, 2003; Korkman, Kirk, & Kemp, 2007). These findings were quite relevant for the existent research, given the fact that the construct of executive functioning in young children continues to be limited, especially for children who are diagnosed as presenting with ASDs.

As stated by a number of authors, the complexity and range of neurocognitive skills and deficits that present in children with ASDs, combined with the nature and limitations of traditionally used measures of EF for the age group, make understanding preschool children with ASDs especially challenging (Klin, Chawarska, Rubin, & Volkmar, et al., 1994). Moreover, while previous research focused on describing characteristics of autism-tendencies in early childhood years, very few studies compared children's executive function profiles based on rating scales with performance-based assessment. This current study's focus on comparing both assessment perspectives adds to the existing literature. Moreover, further investigation may clarify previous studies by Korkman, Kemp, and Kirk (2001) and Isquith, et al. (2005), which supported rapid neurocognitive development during the early childhood years, and which set the groundwork for understanding different patterns of brain-based behavior. Thus, there is a need for additional research focusing on the exploration of executive function profiles in preschool children with developmental delays, as these might ultimately enhance interventions and programs designed to improve their overall quality of life.

As a practicing mental health professional, this researcher understands that it is essential that involvement with children with ASDs be reflective of ongoing transitions and constantly evolving aspects of their lives and achieved through a combination of data-driven interventions and a coordination of support services. Educating children with ASDs requires a task force of committed families, researchers, and therapists all combining their efforts as educators to offer improved opportunities for learning during the important years of early childhood.

References

Adrien, J., Lenoir, P., Martineau, J., Perrot, A., Hameury, L., Larmande, C., & Sauvage, D. (1993). Blind ratings of early symptoms of autism based upon family home movies. *Journal of the American Academy of Child & Adolescence Psychiatry*, *32*(3), 617-626.

Ahmad, S., & Warriner, E. (2001). Review of the NEPSY: A developmental neuropsychological assessment. *Clinical Neuropsychologist*, *15*(2), 240-249.

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington DC: Author.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington DC: Author.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

Autism Society of America. (2003). *What is Autism: Facts and Stats?* Retrieved from http://www.autism-society.org

Baddeley, A. (2002). Is working memory still working? *European Psychologist*, *7*(2), 85-97.

Baron-Cohen, S., Cox, A., Baird, G., Sweettenham, J., & Nighingale, N. (1996). Psychological markers in the detection of autism in infancy in a large population. *British Journal of Psychiatry*, *168*(2), 158-163.

Baron-Cohen, S., Ring, H., Bullmore, E., Wheelwright, S., Ashwin, C., & Williams, S. (2000). The amygdala theory of autism. *Neuroscience and Biobehavioral Reviews*, *24*(3), 355-364.

Bennetto, L., Pennington, B., & Rogers, S. (1996). Intact and impaired memory functions in autism. *Child Development*, *67*(4), 1816-1835.

Bertrand, J., Mars, A., Boyle, C., Bove, F., Yeargin-Allsopp, M., & Decoufle, P. (2001). Prevalence of autism in a United States population: Brick Township, NJ. *Pediatrics, 108*(5), 1155-1161.

Bishop, D., & Norbury, C. (2005). Executive functions in children with communication impairments, in relation to autistic symptomatology I: Generativity. *Autism*, *9*(1), 7-27.

Blair, C., Zelazo, P., & Greenberg, M. (2005). The Measurement of Executive Function in Early Childhood. *Developmental Neuropsychology, 28*(2), 561-571.

de Bruin, E., Ferdinand, R., Meester, S., de Nijs, P., & Verheij, F. (2007). High rates of psychiatric co-morbidity in PDD-NOS. *Journal of Autism and Developmental Disorders*, *37*(5), 877-886.

Burgess, P., Alderman, N., Evans, J., Emslie, H., & Wilson, B. (1998). The ecological validity of tests of executive function. *Journal of the International Neuropsychological Society*, *4*, 547-558.

Carlson, S., Moses, L., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development*, *11*(2), 73-92.

Center for Disease Control and Prevention. *Autism Information Center*. Retrieved from http://www.cdc.gov/ncbddd/dd/ddautism.htm

Ciesielski, K., & Harris, R. (1997). Factors related to performance failure on executive tasks in autism. *Child Neuropsychology, 3*(1), 1-12.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Damasio, A., & Maurer, R. (1978). A neurological model for childhood autism. *Archives of Neurology, 35*(12), 777-786.

Dawson, G., Meltzoff, A., Osterling, J., Rinaldi, J., & Brown, E. (1998). Children with Autism fail to orient to naturally occurring social stimuli. *Journal of Autism and Developmental Disorders*, *28*, 479-485.

De Giacomo, A., & Fombonne, E. (1998). Parental recognition of developmental abnormalities in autism. *European Child and Adolescent Psychiatry 7*, 131-136.

Deisinger, J. (2001). Diagnosis and assessment of autistic spectrum disorders. *Autistic spectrum disorders: Educational and clinical interventions*, 181-209.

Denckla, M. (1994). Measurement of executive function. In Lyon, G. R. (Ed.), *Frames of reference for the assessment of learning disabilities: New views on measurement issues* (pp. 117-142). Baltimore, MD: Paul H Brookes Publishing.

Denckla, M. (1996). A theory and model of executive function: A neuropsychological perspective. *Attention, memory, and executive function* (pp.263-278). Baltimore, MD: Paul H Brookes Publishing.

Dennis, M. (1991). Frontal lobe function in childhood and adolescence: A heuristic for assessing attention regulation, executive control, and the intentional states important for social discourse. *Developmental Neuropsychology 7*, 327-358.

Diamond, A., & Doar, B. (1989). The performance of human infants on a measure of frontal cortex function, the delayed response task. D*evelopmental Psychobiology*, *22*(3), 271-294.

Diamond, A., & Gilbert, J. (1989). Development as progressive inhibitory control of action: Retrieval of a contiguous object. *Cognitive Development, 4,* 221-249.

Dyches, T., Wilder, L., Sudweeks, R., Obiakor, F., & Algozzine, B. (2004). Multicultural Issues in Autism. *Journal of Autism and Developmental Disorders*, *34*(2), 211-222.

Erickson, K., Drevets, W., & Schulkin, J. (2003). Glucocorticoid regulation of diverse cognitive functions in normal and pathological emotional states. *Neuroscience and Biobehavioral Reviews*, *27*(*3),* 233-246.

Espy, K., Kaufmann, P., McDiarmid, M., & Glisky, M. (1999). Executive functioning in preschool children: Performance on A-not-B and other delayed response format tasks. *Brain and Cognition*, *41*(2), 178-199.

Farrant, A., Blades, M., & Boucher, J. (1998). Source monitoring by children with autism. *Journal of Autism and Developmental Disorders*, *28*(1), 43-50.

Filipek, P., Accardo, R, Ashwal, M., Baranek, G., Cook, E., Dawson, G., …Volkmar, F. (2000). Practice parameter: Screening and diagnosis of autism. Report of the quality standards subcommittee of the American Academy of Neurology and the Child Neurology Society. *Neurology*, 66, 468-479.

Filipek, P., Accardo, P., Baranek, G., Cook, E., Dawson, G., Gordon, …Volkmar, F. (1999). The screening and diagnosis of autistic spectrum disorders. *Journal of Autism and Developmental Disorders*, *29*(6), 439-484.

Flanagan, O., & Nuallain, S. (2001). A study looking at the effectiveness of developmental screening in identifying learning disabilities in early childhood. *Irish Medical Journal*, *94*(5), 148-150.

Fombonne, E. (1999). The epidemiology of autism: A review. *Psychological Medicine*, *29*, 769-786.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders*, *33*(4), 365-382.

Fonagy, P., & Target, M. (2002). Early intervention and the development of self-regulation. *Psychoanalytic Inquiry*, *22*(3), 307-335.

Fraenkel, J. & Wallen, N. (2006). *How to Design and Evaluate Research in Education*. (6th ed.). (pp.370-374). New York, NY: McGraw-Hill Press.

Fuster, J. M. (2000). Executive frontal functions. *Experimental Brain Research, 133*, 66-70.

Gillberg, C. (1989). Asperger syndrome in 23 Swedish children. *Developmental Medicine and Child Neurology*, *31*, 520-531.

Gillberg, C. (1991). Outcome in autism and autistic like conditions. *Journal of American Academy of Child and Adolescent Psychiatry*, *30*(3), 375-382.

Gillberg, C., & Wing, L. (1999). Autism: Not an extremely rare disorder. *Acta Psychiatrica Scandinavica*, *99*(6), 399-406.

Gilotty, L., Kenworthy, L., Sirian, L., Black, D., & Wagner, A. (2002). Adaptive skills and executive function in autism spectrum disorders. *Child Neuropsychology*, *8*(4), 241-248.

Gioia, G., Espy, K., & Isquith, P. (2003). *Behavior Rating Inventory of Executive Function, Preschool Version (BRIEF-P)*. Odessa, FL: Psychological Assessment Resources.

Gioia, G., & Isquith, P. (2004). Ecological assessment of executive function in traumatic brain injury. *Developmental Neuropsychology*, *25*(1), 135-158.

Gioia, G., Isquith, P., & Guy, S. (2001). Assessment of executive functions in children with neurological impairment. In R. J. Simeonsson & S. L. Rosenthal (Eds.), *Psychological and developmental assessment: Children with disabilities and chronic conditions*. (pp. 317-356). New York, NY: Guilford Press.

Gioia, G., Isquith, P., Guy, S., & Kenworthy, L. (2000). *Behavior Rating Inventory of Executive Function (BRIEF)*. Odessa, FL: Psychological Assessment Resources.

Gioia, G., Isquith, P., Retzlaff, P., & Espy, K. (2002). Confirmatory factor analysis of the Behavior Rating Inventory of Executive Function (BRIEF) in a clinical sample. *Child Neuropsychology*, *8*(4), 249-257.

Green, S. B. (1991). How many subjects does it take to do a regression analysis? M*ultivariate Behavioral Research, 26*(3), 499–510.

Griffith, E., Pennington, B., Wehner, E., & Rogers, S. (1999). Executive functions in young children with autism. *Child Development, 70*(4), 817-832.

Hala, S., Rasmussen, C., & Henderson, A. (2005). Three types of source monitoring by children with and without autism: The role of executive function. *Journal of Autism and Developmental Disorders*, *35*(1), 75-89.

Hansen, R., & Hagerman, R. (2003). Contributions of pediatrics. *Autism spectrum disorders: A research review for practitioners* (pp. 87-109). Arlington, VA: American Psychiatric Publishing, Inc.

Harris, S., Handleman, J., Gordon, R., Kristoff, B., & Fuentes, F. (1991). Changes in cognitive and language functioning of preschool children with autism. *Journal of Autism and Developmental Disorders*, *21*(3), 281-290.

Harris, S., & Handleman, J. (2000). Age and IQ at intake as predictors of placement for young children with autism: A four-to six-year follow-up. *Journal of Autism and Developmental Disorders, 30*(2), 137-142.

Hill, E. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences, 8*(1), 26-32.

Hill, E., & Russell, J. (2002). Action memory and self-monitoring in children with autism: Self versus other. *Infant and Child Development*, *11*, 159-170.

Hoyson, M., Jamieson, B., & Strain, P. S. (1984). Individualized group instruction of normally developing and autistic-like children: A description and evaluation of the LEAP curriculum model. *Journal of the Division of Early Childhood, 8*, 157-181.

Hughes, C. (1996). Brief report: Planning problems in autism at the level of motor control. *Journal of Autism and Developmental Disorders*, *26*(1), 99-107.

Hughes, C., & Graham, A. (2002). Measuring executive functions in childhood: Problems and solutions? *Child & Adolescent Mental Health*, *7*(3), 131-142.

Hughes, C., Russell, J., & Robbins, T. (1994). Evidence for executive dysfunction in autism. *Neuropsychologia*, *32*(4), 477-492.

Individuals with Disabilities Improvement Act-Data Analysis System (IDEIA-DAS). Retrieved from https://www.ideadata.org/DataProfiles.asp

Isquith, P., Crawford, J., Espy, K., & Gioia, G. (2005). Assessment of executive function in preschool-aged children. *Mental Retardation and Developmental Disabilities Research Reviews*, *11*(3), 209-215.

Isquith, P., Gioia, G., & Espy, K. (2004). Executive function in preschool children: Examination through everyday behavior. *Neuropsychology*, *26*, 403-422.

Joseph, R. (1999). Neuropsychological frameworks for understanding autism. *International Review of Psychiatry, 11*(4), 309-324.

Joseph, R., McGrath, L., & Tager-Flusberg, H. (2005). Executive dysfunction and its relation to language ability in verbal school-age children with autism. *Developmental Neuropsychology*, *27*(3), 361-378.

Kenworthy, L., Black, D., Wallace, G., Ahluvalia, T., Wagner, A., & Sirian, L. (2005). "Disorganization: The forgotten executive dysfunction in high-functioning autism (HFA)." *Developmental Neuropsychology*, *28*(3), 809-827.

Klenberg, L., Korkman, M., & Lahti-Nuuttila, P. (2001). Differential development of attention and executive functions in 3- to 12-year-old Finnish children. D*evelopmental Neuropsychology*, *20*(1), 407-428.

Klin, A., Chawarska, K., Paul, R., Rubin, E., Morgan, T., Wiesner, L., & Volkmar, F. (2004). Autism in a 15-month-old child. *American Journal of Psychiatry, 161*(11), 1981-1988.

Koegel, L., Koegel, R., & Smith, A. (1997). Variables related to differences in standardized test outcomes for children with autism. *Journal of Autism and Developmental Disorders, 27(3),* 233-243.

Kohrt, B. (2004). School psychologists respond to ASD survey. *CASP Today, 53*(1), 4.

Korkman, M. (1999). Applying Luria's diagnostic principles in the neuropsychological assessment of children. *Neuropsychology Review, 9*(2), 89-105.

Korkman, M. (2001). Introduction to the special issue on normal neuropsychological development in the school-age years. *Developmental Neuropsychology*, *20*(1), 325-330.

Korkman, M., Kemp, S., & Kirk, U. (2001). Effects of age on neurocognitive measures of children ages 5 to 12: A cross-sectional study on 800 children from the United States. *Developmental Neuropsychology*, *20*(1), 331-354.

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A Developmental Neuropsychological Assessment*. San Antonio, TX: Psychological Corporation.

Korkman, M., Kirk, U., & Kemp, S. (2007). *NEPSY: A Developmental Neuropsychological Assessment-Second Edition*. San Antonio, TX: Psychological Corporation.

Korkman, M., & Peltomaa, A. (1991). A pattern of test findings predicting attention problems at school. *Journal of Abnormal Child Psychology, 19*(4), 451-467.

Lopez, B., Lincoln, A., Ozonoff, S., & Lai, Z. (2005). Examining the relationship between executive functions and restricted, repetitive symptoms of autistic disorder. *Journal of Autism and Developmental Disorders*, *35*(4), 445-460.

Lord, C. (1995). Follow-up of two-year-olds referred for possible autism. *Journal of Child Psychology and Psychiatry, 36*(8), 1365-1382.

Lord, C. (1997). Diagnostic instruments in autism spectrum disorders. In D. Cohen, & F. Volkmar (Eds.), *Handbook of Autism and Pervasive Developmental Disorders* (2nd ed.). (pp. 460-483). New York, NY: Wiley.

Lovaas, O. (1987). Behavioral treatment and normal intellectual and educational functioning in autistic children. *Journal of Consulting and Clinical Psychology*, *55*, 3-9.

Loveland, K. (1991). Social affordances and interaction: Autism and the affordances of the human environment. *Ecological Psychology*, *3*(2), 99-119.

Luna, B., Doll, S., Hegedus, S., Minshew, N., & Sweeney, J. (2007). Maturation of executive function in autism. *Biological Psychiatry, 5*, 474–481.

Luria, A. (1966). *Human brain and psychological processes*. New York, NY: Harper & Row.

Mahone, E., & Hoffman, J. (2007). Behavior rating of executive function among preschoolers with ADHD. *Clinical Neuropsychologist*, *21*(4), 569-586.

Mandell, D., Listerud, J., Levy, S., & Pinto-Martin, J. (2002). Race differences in the age at diagnosis among Medicaid-eligible children with autism. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(12), 1447-1453.

Mackinlay, R., Charman, T., & Karmiloff-Smith, A. (2006). High functioning children with autism spectrum disorders: A novel test of multitasking. *Brain and Cognition*, *61*(1), 14-24.

McAlonan, G., Cheung, V., Cheung, C., Suckling, J., Lam, G., Tai, K., …Chua, S. (2005). Mapping the brain in autism: A voxel-based MRI study of volumetric differences and intercorrelations in autism. *Brain: A Journal of Neurology*, *128*(2), 268-276.

McEvoy, R., Rogers, S., & Pennington, B. (1993). Executive function and social communication deficits in young autistic children. *Journal of Child Psychology and Psychiatry*, *34*(4), 563-578.

Minshew, N., Sweeney, J., & Bauman, M. (1997). Neurologic aspects of autism. In D. Cohen & F. Volkmar (Eds.), *Handbook of autism and pervasive developmental disorders* (2nd ed., pp. 344-369).

Moore, V., & Goodson, S. (2003). How well does early diagnosis of autism stand the test of time? Follow-up study of children assessed for autism at age 2 and development of an early diagnostic service. *Autism*, *7*(1), 47-63.

Muhle, R., Trentacoste, S., & Rapin, I. (2004). The Genetics of Autism. *Pediatrics*, *113*(5), 472-486.

National Institute of Mental Health. *Autism spectrum disorders (Pervasive Developmental Disorders).* Retrieved from http://www.nimh.nih.gov/health/topics/autism-spectrum-disorders-pervasive-developmental-disorders/index.shtml.

National Research Council, Division of Behavioral and Social Sciences Education. (2001). *Educating Children with Autism* (pp. 186). Washington, DC: National Academy Press.

Nikolov, R., Bearss, K., Lettinga, J., Erickson, C., Rodowski, M., Aman, M., …Scahill, L. (2009). Gastrointestinal symptoms in a sample of children with pervasive developmental disorders. *Journal of Autism & Developmental Disorders*, *39*(3), 405-413.

Nydén, A., Carlsson, M., Carlsson, A., & Gillberg, C. (2004). Interhemispheric transfer in high-functioning children and adolescents with autism spectrum disorders: A controlled pilot study. *Developmental Medicine and Child Neurology*, *46*(7), 448-454.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders, 24,* 247-257.

Osterling, J., Dawson, G., & Munson, J. (2002). Early recognition of 1-year-old infants with autism spectrum disorders versus mental retardation. *Development and Psychopathology, 14*(2), 239-251.

Ozonoff, S. (1997). Components of executive function in autism and other disorders. *Autism as an executive disorder* (pp. 179-211). New York:: Oxford University Press.

Ozonoff, S., Cook, I., Coon, H., Dawson, G., Joseph, R., & Klin, A. et al. (2004). Performance on Cambridge Neuropsychological Test Automated Battery subtests sensitive to frontal lobe function in people with autistic disorder: Evidence from the Collaborative Programs of Excellence in Autism Network. *Journal of Autism & Developmental Disorders, 34*(2), 139-150.

Ozonoff, S., & Jensen, J. (1999). Brief report: specific executive function profiles in three neurodevelopmental disorders. *Journal of Autism and Developmental Disorders*, 29,171-177.

Ozonoff, S., Pennington, B., & Rogers, S. (1991). Executive function deficits in high-functioning autistic individuals: Relationship to theory of mind. *Journal of Child Psychology and Psychiatry, 32*(7), 1081-1105.

Ozonoff, S., & Strayer, D. (2001). Further evidence of intact working memory in autism. *Journal of Autism and Developmental Disorders*, *31*(3), 257-263.

Pennington, B. (1991). *Diagnosing Learning Disorders: A Neuropsychological Framework*. New York, NY: Guilford Publications.

Pennington, B., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry, 37*(1), 51-87.

Pennington, B., Rogers, S., Bennetto, L., Griffith, E., Reed, D., &Shyu, V. (1997). Validity tests of the executive dysfunction hypothesis of autism. In: Russell J., (Ed.), *Autism as an Executive Disorder.* (pp. 143-178). New York, NY: Oxford University Press.

Pennington, B., Welsh, M. (1995). Neuropsychology and developmental psychopathology. In: D, Cicchetti, D. Cohen (Eds.). *Handbook of Developmental Psychopathology.* (pp. 254-290). Cambridge, MA: Cambridge University Press.

Prior, M., Hoffmann, W. (1990). Neuropsychological testing of autistic children through an exploration with frontal lobe tests. *Journal of Autism and Developmental Disorders*, 20, 581-590.

Rice, C. (2007). Prevalence of autism spectrum disorders –autism and developmental disabilities monitoring network, 14 sites, United States, 2002. *Morbidity and Mortality Weekly Report*, *56,* 12-28.

Rimland, B. (1964). *Infantile Autism*. East Norwalk, CT US: Appleton-Century-Crofts.

Ritvo, E., Freeman, B., Pingree, C., & Mason-Brothers, A. (1989). The UCLA-University of Utah epidemiologic survey of autism: Prevalence. *American Journal of Psychiatry*, *146*(2), 194-199.

Roberts, R., Pennington, B. (1996). An interactive framework for examining prefrontal cognitive processing. *Developmental Neuropsychology*. 12, 105-126.

Rogers, S. (1998). Neuropsychology of autism in young children and its implications for early intervention. *Mental Retardation& Developmental Disabilities Research Reviews: Special Issue: Autism*, *4*(2), 104-112.

Rogers, S. & Lewis, H. (1989). An effective day treatment model for young children with pervasive developmental disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, 28, 207-214.

Rogers, S., Ozonoff, S., Maslin-Cole, C. (1993). Developmental aspects of attachment behavior in young children with pervasive developmental disorders. *Journal of the American Academy of Child and Adolescence of Psychiatry*, 32, 1274-1282.

Rosenthal, R., & Rosnow, R. (1991). *Essentials of behavioral research: Methods and data analysis* (2nd ed.). New York, NY: McGraw-Hill Press.

Russell, J. (1997). How executive disorders can bring about an inadequate "theory of mind." *Autism as an executive disorder* (pp. 256-304). New York, NY: Oxford University Press.

Russell, J., Jarrold, C., & Henry, L. (1996). Working memory in children with autism and with moderate learning difficulties. *Journal of Child Psychology and Psychiatry*, *37*(6), 673-686.

Russell, J., & Hill, E. (2001). Action-monitoring and intention reporting in children with autism. *Journal of Child Psychology and Psychiatry*, *42*(3), 317-328.

Rutter, M. (2000). Genetic studies of autism: From the 1970s into the millennium. *Journal of Abnormal Child Psychology*, *28*(1), 3-14.

Schmitt, A., & Wodrich, D. (2004). Validation of a Developmental Neuropsychological Assessment (NEPSY) through comparison of neurological, scholastic concerns, and control groups. *Archives of Clinical Neuropsychology*, *19*(8), 1077-1093.

Senn, T., Espy, K., & Kaufmann, P. (2004). Using Path Analysis to Understand Executive Function Organization in Preschool Children. *Developmental Neuropsychology*, *26*(1), 445-464.

Shaffer, J. (1995). Multiple Hypothesis Testing. *Annual Review of Psychology*, 46, 561-584.

Short, A., & Schopler, E. (1988). Factors relating to age of onset in autism. *Journal of Autism and Developmental Disorders, 18*(2), 207-216.

Sinzig, J., Morsch, D., Bruning, N., Schmidt, M., & Lehmkuhl, G. (2008). Inhibition, flexibility, working memory and planning in autism spectrum disorders with and without comorbid ADHD-symptoms. *Child and Adolescent Psychiatry and Mental Health*, *2*.

Smith, M. (2001). *Autism Caucus; Coalition for Autism Research and Education Information and updates.* Retrieved July 3, 2008, from http://www.house.gov/chrissmith.

Sparks, B., Friedman, S., Shaw, D., Aylward, E., Echelard, D., Artru, A. et al. (2002). Brain structural abnormalities in young children with autism spectrum disorders. *Neurology*, *59*(2), 184-192.

Sparrow, S., Marans, W., Klin, A., Carter, A., Volkmar, F., & Cohen, D. (1997). Developmentally based assessments. In D. Cohen & F. Volkmar (Eds.), *Handbook of Autism and Pervasive Developmental Disorders* (2nd ed). (pp. 411-447). New York, NY: John Wiley.

Stone, W. (1997). Autism in infancy and early childhood. In D. Cohen & F. Volkmar (Eds.), *Handbook of Autism and Pervasive Developmental Disorders* (2nd ed.) (pp. 266-282). New York, NY: John Wiley.

Stone, W., Lee, E., Ashford, L., Brissie, J., Hepburn, S., Coonrod, E., et al. (1999). Can autism be diagnosed accurately in children under 3 years? *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40*(2), 219-226.

Stone, W., Ousley, O., Yoder, P., Hogan, K., & Hepburn, S. (1997). Nonverbal communication in 2- and 3-year old children with autism. *Journal of Autism and Developmental Disorders*, 27, 677–696.

Tuchman, R., Rapin, I. (2002). Epilepsy in autism. *Lancet Neurology*, *1*(6), 352-358. United States of Education: (2006) *Building the Legacy: IDEIA 2004*. Retrieved on October 17, 2008, from www.idea.ed.gov.

United States Department of Education. *Special Education New Jersey Administrative Code Title 6A Education Chapter 14 Special Education Authority*. Retrieved February 18, 2009, from

http://www.state.nj.us/education/code/current/title6a/chap14.pdf.
United States Department of Education. (2001). *The No Child Left Behind Act of 2001*. Retrieved February 18, 2009, from http://www.nichy.org/Disabilities/Specific/pages/autism.aspx.

United States Department of Labor, Health, & Human Services. (2006). *The Combating Autism Act of 2006*. Retrieved on March 27, 2009 from http://www.autismspeaks.org/government_affairs/combating_autism_act.php.

Vig, S., & Jedrysek, E. (1999). Autistic features in young children with significant cognitive impairment: Autism or mental retardation? *Journal of Autism and Developmental Disorders*, *29*, 235-248.

Volkmar, F., Chawarska, K., & Klin, A. (2005). Autism in Infancy and Early Childhood. *Annual Review of Psychology*, *56*, 315-336.

Volkmar, F., Cook Jr, E., Pomeroy, J., Realmuto, G., & Tanguay, P. (1999). Summary of the Practice Parameters for the Assessment and Treatment of Children, Adolescents, and Adults with Autism and other Pervasive Developmental Disorders. *American Academy of Child and Adolescent Psychiatry*. *38*(12), 1611-1616.

Volkmar, F., & Cohen, D., (1991). Comorbid association of autism and schizophrenia. *American Journal of Psychiatry*, 148, 1705-1707.

Volkmar, F., Klin, A., Schultz, R., Bronen, R., Marans, W., Sparrow, S. et al. (1996). Asperger's syndrome. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*(1), 118-1123.

Volkmar, F., Klin, A., Siegel, B., Szatmari, P., Lord, C., Campbell, M. (1994). Field trial for autistic disorder in DSM-IV. *American Journal of Psychiatry, 151*(9), 1361-1367.

Welsh, M., & Pennington, B. (1988). Assessing frontal lobe functioning in children: Views from developmental psychology. *Developmental Neuropsychology*, *4*,199-230.

Welsh, M., Pennington, B., Ozonoff, S., Rouse, B., & McCabe, E. (1990). Neuropsychology of early-treated phenylketonuria: Specific executive function deficits. *Child Development, 61*, 1697-1713.

Williams, D., Goldstein, G., Carpenter, P., & Minshew, N. (2005). Verbal and Spatial Working Memory in Autism. *Journal of Autism and Developmental Disorders*, *35*(6), 747-756.

Williams, D., Goldstein, G., & Minshew, N. (2006). The profile of memory Function in children with autism. *Neuropsychology, 20*(1), 21-29.

Youngwirth, S., Harvey, E., Gates, E., Hashim, R., & Friedman-Weieneth, J. (2007). Neuropsychological abilities of preschool-aged children who display hyperactivity and/or oppositional-defiant behavior problems. *Child Neuropsychology*, *13*(5), 422-443.

Zelazo, P., Carter, A., Reznick, J., & Frye, D. (1997). Early development of executive function: A problem-solving framework. *Review of General Psychology*, *1*(2), 198-226.

APPENDICES

APPENDIX A

SITE SPONSOR LETTER

OCT-14-2008 TUE 10:29 AM FAX NO. 31 P. 01

MIDDLESEX REGIONAL EDUCATIONAL SERVICES COMMISSION

1660 Stelton Road
Piscataway, NJ 08854

Telephone: (732) 777-9848 *Fax: (732) 777-9856*

SERVICES:
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Bright Beginnings Learning Center
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Middlesex County Academy
NuView Academy
Raritan Valley Academy
Interim Alternative Educational Program
Cooperative Transportation
Home Instruction
Nonpublic School Services
Child Study Team & Related Services
Professional Development Academy

Mark J. Finkelstein
Superintendent

Patrick M. Moran
Business Administrator/ Board Secretary

October 14, 2008

Ms. Maria J. Colon-Torres, MA
School Psychologist
Doctoral Candidate
Indiana University of Pennsylvania
Stouffer Hall, Room 246
1175 Maple Street
Indiana, PA 15705

RE: Approval of Doctoral Research Study

Dear Ms. Colon-Torres:

Please be advised that your request to conduct a research study within the Middlesex Regional Educational Services Commission's schools as part of your doctoral program is hereby approved. Specifically, this study will take place at the Bright Beginnings Learning Center and the Academy Learning Center. I have spoken with Principal Eaton and Principal Solberg who have been briefed as to the nature of your study. Both have been requested to extend every courtesy to you.

With best wishes for continued success in the future.

Sincerely,

Mark J. Finkelstein
Superintendent

APPENDIX B

Indiana University of Pennsylvania
www.iup.edu

Department of Educational and School Psychology
Stouffer Hall, Room 246
1175 Maple Street
Indiana, Pennsylvania 15705-1058

P 724-357-2316
F 724-357-6946
www.iup.edu/schoolpsychology

PARENTAL INFORMED CONSENT

Dear Parent/Guardian:

My name is Maria J. Colon-Torres, and I am a doctoral student at Indiana University of Pennsylvania. This letter is to request your permission for your child to participate in a research study entitled: "*Comparison of Executive functions of Preschool Students with Autism Disorder.*"

The purpose of the study is to better understand the decision making process among young students diagnosed with autism spectrum disorders or pervasive developmental disorders, in hope of providing improved and tailored learning strategies for these students. Participation in this study is completely voluntary, and will not affect any evaluation of your child's performance in school. Furthermore, you may withdraw your child from the study at any time by contacting the primary investigator by phone, email, or mail (see information below). Upon your request to withdraw, all information pertaining to your child will be destroyed. It should be noted that all information will solely be used for research purposes, and will have no bearing on your child's educational program, nor will any information will be used as part of a psychological evaluation.

This study will involve three basic steps. First, the classroom teacher will complete a behavioral rating scale on your child. The second step involves a review and completion of a Comprehensive Clinical History Form based on your child's educational records. A copy of the Comprehensive Clinical History Form has been attached to this consent form. Third, your child will be excused from the classroom to take one test. The structure of the administration of the test has a flexible approach, which allows for teaching opportunities prior to each subtest. The tests involve a series of tasks that provide information on the child's attention, non-verbal problem solving, inhibition and self-regulation. Your child will be presented with items that include a ball, pegs, a recorded list of words, picture cards, and paper and pencil. The test will take approximately ***30-45 minutes***. Your child will be tested during school hours, and given a $5.00 gift certificate to ***Barnes and Noble*** for their participation. All study steps described above will be conducted by this investigator and gathered data will be secured for three years, and after that period this information will be shredded accordingly. Once again, if you choose to give your child permission to participate and you or your child does not feel comfortable with participation in this study, you may choose to withdraw at any time and still receive a gift certificate. *By giving consent, you are also allowing the examiner to have access to your child's confidential records. Specific information such as developmental milestones, early intervention services, other diagnosed medical conditions, as well as age of onset and diagnostic criteria will be recorded as part of the data gathering process. Because your child is not able to give assent due to age and/or disabling condition, parents are the ones solely responsible for providing consent.*

All individual responses will be held in strict confidence; only group results will be analyzed and reported. The information obtained in the study may be published in a scientific journal or presented at a scientific meeting, but all identifying information will be kept confidential.

If you are willing to have your child participate in the study, please sign the statement on the next page and promptly return to the address provided. The testing will occur during the spring of 2010. This project has been approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730).

Sincerely,

Maria J. Colon-Torres, MA
Doctoral Candidate
Indiana University of Pennsylvania
Educational and School Psychology
Stouffer Hall, Room 246
1175 Maple Street
Indiana, PA 15705
724-357-2316
M.J.Colon-Torres@iup.edu

Lynanne Black, PhD.
Assistant Professor
Indiana University of Pennsylvania
Educational and School Psychology
Stouffer Hall, Room 242
1175 Maple Street
Indiana, PA 15705
724-357-4757
lblack@iup.edu

CONSENT FORM

I have read and understand the information and consent for my child to be a volunteer in this study. I understand that all information will be completely confidential and that I have the right to withdraw my child at any time. I have received an unsigned copy of this form to keep in my possession. I understand that child assent is not able to be obtained and that I am the authorized individual to give consent for my child's participation in this study.

PARENT'S NAME: ____

SIGNATURE:

____

CHILD'S NAME: ____

Please return this form to the main office in the envelope provided.

If you should have further questions about the nature and purpose of the study, the potential benefits and possible risks, or any other questions, please contact Maria Colon-Torres, Doctoral Candidate, Indiana University of Pennsylvania, Educational and School Psychology Department, Stouffer Hall-Room 246, 1175 Maple Street, Indiana, PA 15705, (724) 357-2316, M.J.Colon-Torres@iup.edu.

APPENDIX C

Indiana University of Pennsylvania
www.iup.edu

Department of Educational and School Psychology
Stouffer Hall, Room 246
1175 Maple Street
Indiana, Pennsylvania 15705-1058

P 724-357-2316
F 724-357-6946
www.iup.edu/schoolpsychology

TEACHER INFORMED CONSENT

Dear Classroom Teacher:

My name is Maria J. Colon-Torres, and I am a doctoral student at Indiana University of Pennsylvania, and currently in the dissertation phase of my program. My research is entitled: *"Comparison of Executive functions of Preschool Students with Autism Disorder."* The rationale of this study is to assist school professionals with increasing their awareness and understanding of complex cognitive processes, such as executive functions, which may be compromised in young students diagnosed with autism spectrum disorders or pervasive developmental disorders. Limited research is available on executive functions of preschool children with autism, and little is known about tailored and intensive strategies based on individual learning profiles of strengths and weaknesses, which will ultimately impact the overall academic and social outcomes for the young child with autism.

This letter is to both inform you of my study, as well as to request your participation. Please note that all participation is completely voluntary, and has absolutely no affiliation with Middlesex County Public Schools. Therefore, should you choose not to participate, there will be no adverse consequences to your employment. Also, if you choose to participate, you may withdraw from the study at any time by contacting me at the address, phone or email listed below.

The study will involve three basic steps. First, as the classroom teacher, you will be asked to complete a 63 item behavioral checklist, named the Brief Rating Inventory of Executive Functioning Skills- Preschool Version (BRIEF-P) on one or more of your preschool students. This checklist takes approximately 10-15 minutes to complete, and does not requires scoring on your part. The second step involves a review and completion of a Developmental History Form by myself based on a review of your student's educational records. A copy of the Developmental History Form has been attached to this consent form. Third, the student will be excused from class to take one test with this examiner. The structure of the administration has a flexible approach, which allows for teaching opportunities prior to each subtest. The tests involve a series of tasks that provide information on the child's attention, non-verbal problem solving, inhibition and self-regulation. The student will be presented with items that include a ball, pegs, a recorded list of words, picture cards, and paper and pencil. The test will take approximately ***30-45 minutes***. The student will be tested during school hours. Each teacher who completes a BRIEF-P checklist on one or more of his/her students will be given a $20.00 gift certificate to ***Barnes and Noble*** for their participation.

All information gathered in this study will have the full and complete consent of parents. By giving consent, the examiner will have access to academic records, so that developmental milestones, early intervention services, other medical conditions, as well as age of onset and diagnostic criteria can be recorded as part of the data gathering process.

All individual responses will be held in strict confidence, only group results will be analyzed and reported. The information obtained in the study may be published in a scientific journal or presented at a scientific meeting, but all identities will be confidential. The testing will occur during the months of March and April 2010.

This project has been approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730). There are no known risks or discomforts associated with this research.

If you should have any additional questions, please contact either persons listed below. We appreciate your cooperation and support by participating in this study. If you choose not to participate, please return the unsigned consent in the enclosed envelope.

Sincerely,

Maria J. Colon-Torres, MA
Doctoral Candidate
Indiana University of Pennsylvania
Educational and School Psychology
Stouffer Hall, Room 246
1175 Maple Street
Indiana, PA 15705
724-357-2316
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Assistant Professor
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Indiana, PA 15705
724-357-4757
lblack@iup.edu

CONSENT FORM

I have read and understand the information and consent to be a volunteer in this study. I understand that all information will be completely confidential and that I have the right to withdraw my participation at any time. I have received an unsigned copy of this form to keep in my possession. I understand and agree to participate in this research.

TEACHER'S NAME: ____

SIGNATURE: ____

Please return this form to the main office in the envelope provided.

If you should have further questions about the nature and purpose of the study, the potential benefits and possible risks, or any other questions, please contact Maria Colon-Torres, Doctoral Candidate, Indiana University of Pennsylvania, Educational and School Psychology Department, Stouffer Hall-Room 246, 1175 Maple Street, Indiana, PA 15705, (724) 357-2316, M.J.Colon-Torres@iup.edu

APPENDIX D

NEPSY-II

Clinician Sample Report

Portion of Sample Report; NEPSY-II

Memory and Learning				
Score Name	**Raw Scores**	**Scaled Scores**	**Percentile Ranks (%)**	**Classification**
Memory for Designs Total Score				
Memory for Designs Content Score				
Memory for Designs Spatial Score				
MD Content vs. Spatial Contrast Scaled Score				
Narrative Memory Free and Cued Recall Total Score				
Narrative Memory Recognition Total Score				
NM Free and Cued Recall vs. Recognition Contrast Scaled Score				
Sentence Repetition Total Score				

Note. Portions of Clinician Sample Report reproduced by special permission of the Publisher, Harcourt Assessment, 19500 Bulverde Road, San Antonio Texas 78259-3701, from A Developmental Neuropsychological Assessment, Second Edition by Ursula Kirk, Marit Korkman, and Sally Kemp.

APPENDIX E

BRIEF-P Scale Sample Items

Sample Items: BRIEF-P; RATING FORM-Teacher Version

Shift Subscale Sample Item: "Is disturbed by changes in the environment (such as new furniture, things in room moved around, or new clothes)"

Emotional Control Subscale Sample Item: "Small events trigger big reactions"

Plan/Organize Subscale Sample Item: "Has trouble following established routines or sleeping, eating, or play activities"

Note. Sample items reproduced by special permission of the Publisher, Psychological Assessment Resources, Inc., 16204 North Florida Avenue, Lutz Florida 33549, from the Behavior Rating Inventory of Executive Function-Preschool Version by Gerard A. Gioia, Kimberly Andrews Espy, and Peter K. Isquith.